Matters of Public Policy and Central Station Management—*Features of a Connecticut Hydroelectric System which Exchanges energy with Several Steam Stations and the regular departments*

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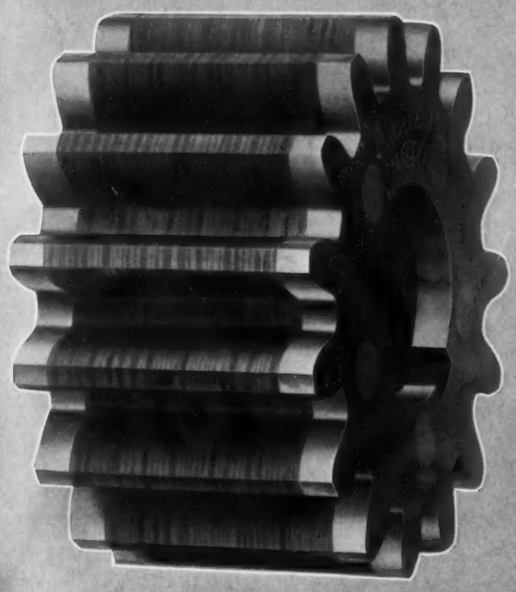

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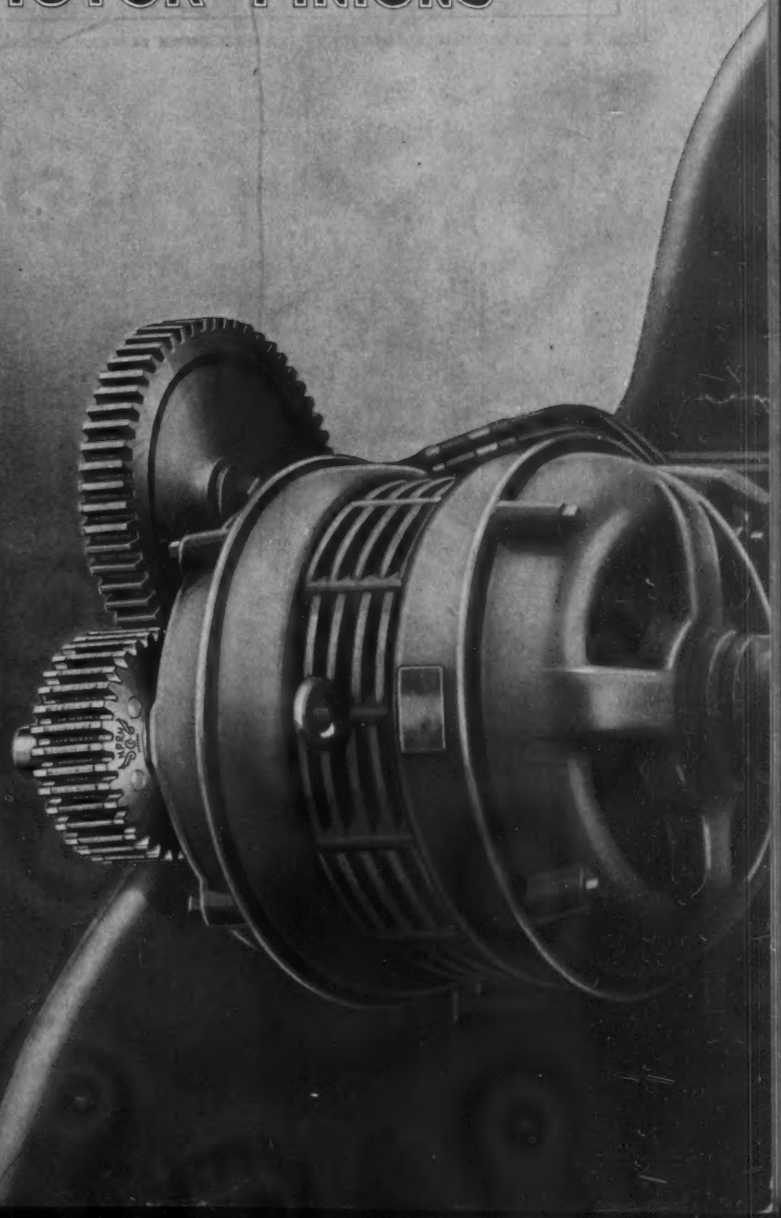

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The United Engineering Societies Council

SPECIALISM has its advantages and its disadvantages. This is only another way of saying that no human institution can be perfect, or possess all the good things to the exclusion of the bad. An advantage of specialism is that by confining attention of each individual or group of individuals to a particular group of activities, greater effectiveness and greater efficiency can be secured in all directions. A disadvantage of specialism is that the associations, views and habits of the individual necessarily become relatively delimited and narrowed.

Engineering as a profession is, in a broad sense, a great field of endeavor in which the basic principles are everywhere the same. Mathematics, physics, chemistry and various other branches of science are applied to the business of the world through economics, direction and discipline, so as to secure the maximum of joint constructive production with the minimum of inconvenience, expense and delay. According to any such broad interpretation of the nature and purposes of engineering, one might suppose that all engineering was essentially the same, and called for the services of one and the same group of technically trained men. We all know, however, that the field of engineering is so large that no one man can possibly possess the knowledge and experience necessary for efficiently conducting work in all of its departments. In order to give good engineering service, specialism is necessary, and there are to-day half a dozen main branches of engineering, each branch having perhaps half a dozen distinct sub-branches.

This necessary specialism in engineering divides engineers as a body into a number of groups, so distinct one from another that the technical language of one may hardly be understood in another. It is like the case of the dog, which is generally admitted to be a quadruped of the genus *canis*, but as existing in nearly a hundred different species, some among which differ so profoundly in qualities and dimensions as to make it difficult to believe that the single term "dog" applies alike to all.

The subdivision of breeds among engineers makes it very difficult for them to make common cause in any joint effort for the benefit of the community. The totems they follow are so different as almost to amount to castes in exclusiveness. This is a real misfortune, both for the engineers and for the country they serve. They may be particularly well qualified to express opinions, or to suggest courses of action in grave emergencies, owing to their training and experience, and yet, owing to their multiple-cursedness, they are prevented from giving adequate expression either to opinions or to suggestions.

It is stated that a movement is on foot to co-ordinate the disjunctions among American engineers by forming a United Engineering Societies Council, for the purposes of collective utterance and action, when occasion may demand. If this movement is effected logically and automatically, it may be a great boon for the engineers and also for America. If the movement is made unfortunately, the last state of the engineers may be worse than the first. We wish the movement every success. There is need for it.

Recognition of Good Management

AS regulation by state public utility commissions in this country has progressed, it has become more and more evident that incentive for good service and economical management which would produce a rate of return on the investment in excess of that generally allowed by commissions thus far would soon be destroyed unless the regulatory bodies gave recognition to the better managed properties by allowing an increased rate of return. Indeed, some managements have begun to feel that efforts to reduce operating expenses so that the investment would show more than a certain rate of return are a waste of energy, and this also applies to the installation of more economical apparatus involving additional investment. The State Public Utilities Commission of Illinois has evidently felt this danger. In its decision in the Lincoln Water & Light Company case recently announced the commission states that once it has fixed a reasonable rate of return in a rate case it is agreeable, at any future date, to consider an increase in the rate of return, based on exceptional operating performances. In other words, the commission is willing "to reproportion savings made by the utility's management between increased profits to the stockholders and reduced rates to the consumers, rather than to declare that all such further savings should accrue solely to the public." While this expression from the commission is a promise for the future, it is nevertheless very encouraging as a pronunciamento from a regulatory body. It is, of course, not altogether easy to determine how much increased profits are due to conditions beyond the control of the management and how much of it is the result of skillful operation. However, this problem is no more difficult for a well-organized commission to solve than establishing the fair rate of return upon the investment or promulgating standards of good service. The mere fact that the question is being considered is satisfying.

Connecticut Transmission Systems

THE system of the Connecticut Power Company, described in this issue, is of more than usual interest to the engineer on account of the fact that it is thoroughly typical of conditions which exist in many parts of the country, where useful water powers of moderate size are linked up with steam stations, existing or new, to form an interconnected system capable of utilizing the full value of the hydraulic resources. The main plant of the company is at Falls Village on the Housatonic River, with a subsidiary plant higher up on this stream at Canaan. The installation at Falls Village consists of three 3000-kw. units, that at Canaan of two 300 kw., with a small steam auxiliary. The scheme of development has been to build the Falls Village plant for the production of an exceptionally large proportion of the available power, thereby utilizing the privilege as fully as feasible. The Canaan plant in itself is small and comparatively unimportant, but it bears a very significant relation to the main plant in that its storage area 6 miles above Falls Village is great, bringing the total for the system to 42,000,000 cu. ft. The acquisition of this smaller plant therefore enabled the larger one to be brought to a fuller development and defended it against being seriously incommoded by the storage of water at some of the mills on the stream. At times of high water the Canaan plant is almost out of business, but at low water it can operate at its full head, which is only 12 ft., and run its comparatively large flowage through to the higher head of the main plant below. Here again is an advantageous union of two hydraulic privileges, one of them so small as to be unpromising by itself, but working admirably in conjunction with the other.

To the engineer the chief interest of the Falls Village plant is the thorough investigation that was made of the hydraulic situation before the system was finally constructed. The head is at a maximum of 110 ft., but distributed over two natural falls, and five separate schemes for the combined utilization of the head were exhaustively studied before the final plan was completed. This involved a small sacrifice of head, but made it possible to use a considerable stretch of an old dry masonry canal built on this site more than sixty years ago. With its walls built up and the whole lined with reinforced concrete, it became possible to convey the water so as to dispense with the extremely long pipe lines, which would have been necessary to the other schemes. The final penstocks have been kept down to 400 ft. in length, thereby both lowering the cost and improving the regulation. Of the main hydraulic plant itself little need be said except to call attention to the fact that it is rather unusually simple in its switchboard design. The power is generated at 6600 volts and the main transmission is of the now usual type, with steel towers and suspension insulators, at 66,000 volts. This main line to Bristol is a double-circuit one, 40 miles long, fitted with a ground wire above the towers. From Bristol to Berlin, 13.5 miles, more similar towers are used but as yet carrying only a single circuit. This transmission is connected with both Hartford and New Britain. These secondary lines, however, are on wooden poles 40 to 45 ft. long, and spaced 180 ft. apart, showing thereby the modern tendency to departure from the old short spacings which are a hand-me-down from slender telegraph and telephone poles carrying a great mass of wires. These poles are equipped with suspension insulators, four disks in series, and at frequent intervals are guyed in two directions. The connected steam systems are provided by the stations of the Torrington Electric Company, the Bristol & Plainville Tramway Company, the United Electric & Water Company and the Hartford Electric Light Company, from any or all of which power can be drawn when necessary. A further extension is now under way which will unite this system with the Middletown steam station of the Connecticut Power Company.

The Importance of Lighting Load

AT every increase in the efficiency of electrical illuminants there have been dire predictions that the lighting end of the electricity supply business was going to the dogs, and the only hope of continued prosperity lay in a large increase of motor service. In point of solemn fact, every increase in the efficiency of illuminants has encouraged more and better lighting, and in the long run the lighting load has steadily risen through the entire period of improvement. The fundamental fact in the situation is that artificial lighting is, on the whole, still so far from natural lighting in measure of intensity that the inevitable tendency of the former must be upward. It is true that one can see to read or write with 2 or 3 foot-candles of illumination. It is equally true that one is used to working with five or ten times this amount through the hours of daylight, and consequently a certain wrench is felt in passing from natural to artificial light. Eventually the eyes accommodate themselves to the new conditions and, considering what they are, they perform remarkably well. Yet there is little doubt that the period of this passage is one of relative inefficiency, which would be obviated if the intensities before and after the change were more commensurate. It is in response to this mental, rather than physical, condition that there has been a steady rise in the illumination demanded by popular consent, so soon as increased efficiency of the illuminants themselves has made better lighting economical and feasible.

Mr. Durgin in his article last week called attention to the strenuous efforts which have been made to increase the motor and miscellaneous load, attractive to the central station by reason of the comparative simplicity of the service. To one attempting to analyze the real situation, however, it becomes apparent that full advantage has not yet been taken of the economic possibilities of the lighting load. The cost of service is undeniably greater in this class of work, but whether the increased profits do not more than justify the costs is quite another matter. There is little doubt that numerous central stations are supplying the preferred

class of motor customers at a price dangerously near to cost. The desire to obtain all the practicable load, thereby increasing station capacity and decreasing station costs, is a perfectly natural and proper one. It must not be forgotten, however, that the generating costs eventually tend to become asymptotic. In other words, there is a certain capacity beyond which costs diminish slowly if at all, and any increase of load above this point makes very little impression on the net profits obtained from any class of customers. It may therefore happen that a very large increase of railway or motor load, producing most impressive results on the total output, really implies a comparatively small net profit, much smaller than would be obtained, from that critical point on, by a similar access of lighting load. The obvious reason for extremely low power rates is to increase the load factor and thus diminish the cost of generation. The fact that this diminution is not continuous sets a limit to the profit-bearing qualities of such loads.

Another feature of the situation to which Mr. Durgin very properly called attention is the importance of increase of lighting service from the standpoint of public affairs. The humble householder using electric lighting in his flat has a vote which is just as valuable in determining public policies as that of the captain of industry who takes 10,000 hp. from the central station at a price barely yielding a living profit. In fact the former personage invariably exercises his right to vote, while the latter is more likely to do something else and usually takes no active interest in ordinary civic affairs at all. We are not disposed to echo the biblical advice to "Make to yourselves friends of the mammon of unrighteousness," but it is a fact that the company which looks carefully and sympathetically after the interests of its small consumers is likely to have a great many friends in time of need, while if it is solicitous about the interests of big business only it acquires a fund of somewhat justly imputed distrust and is looked upon by the general consumer as an advocate of the "public be damned" policy. It is for this very practical reason that many important lighting companies make so much of their illuminating engineering or lighting service work. This represents an endeavor, primarily to encourage the lighting consumer to a higher standard of illumination, and better results, and secondarily, a determination to make friends with every man who is a patron of the company whether his bill is $1 a month or $500. The wisdom of the policy ought to be sufficiently obvious.

Industrial Controllers

IN the early days of the direct-current shunt motor, of say 1-kw. size, the starting of the machine was an undertaking calling for fitting ceremonies and auspicious convocation. The chief starter called his assistants to attention, refreshed his memory by inspecting anew the printed list of directions, and, having ascertained that the armature circuit was safely open, he uttered an incantation and closed the shunt-field switch on the mains. An assistant then took a bunch of keys, or a handy wrench, and proceeded to demontrate by optical and muscular observation that the field poles were duly and truly magnetized. A sigh of relief having been given, minute care was then devoted to the rocker arm and brushes on the commutator, to make sure that the brushes themselves rested firmly on the neutral point.

The assistant having this delicate matter in charge reported all correct to the assistant having charge of the rheostat in the armature circuit, who, having satisfied himself that the resistance was all in, reported to the chief starter, who after shouting "look out," closed the armature switch on the mains. With fireworks at the brushes, the armature would begin to rotate, and the assistant at the brushes would manipulate the brush rocker arm with the gestures of a despairing man. The assistant at the rheostat proceeded to cut out resistance steps with bated breath. When the machine safely reached full speed, and all the rheostat was cut out, with the brushes in fairly good order, all hands would shout a *Te Deum;* while the starting staff mopped their foreheads.

As a contrast with the foregoing technique from ancient history, reference may be taken to the paper by H. D. James, read at the recent mid-winter New York convention of the American Institute of Electrical Engineers. An abstract of the paper appears elsewhere in this number. The paper shows that the regular process of starting and accelerating shunt motors of 10-kw. or 15-kw. capacity, with only one or two steps of starting resistance, is conducted automatically after the mere closing of a main switch. The process takes effect so smoothly that it takes an oscillograph to make the steps significant.

Nevertheless, in spite of the great strides that have been made in motors and motor starting during the last thirty years, the paper points out that there is still much room for investigation, improvement and design in the application of the motor controller to industrial practice.

The Coming Issues

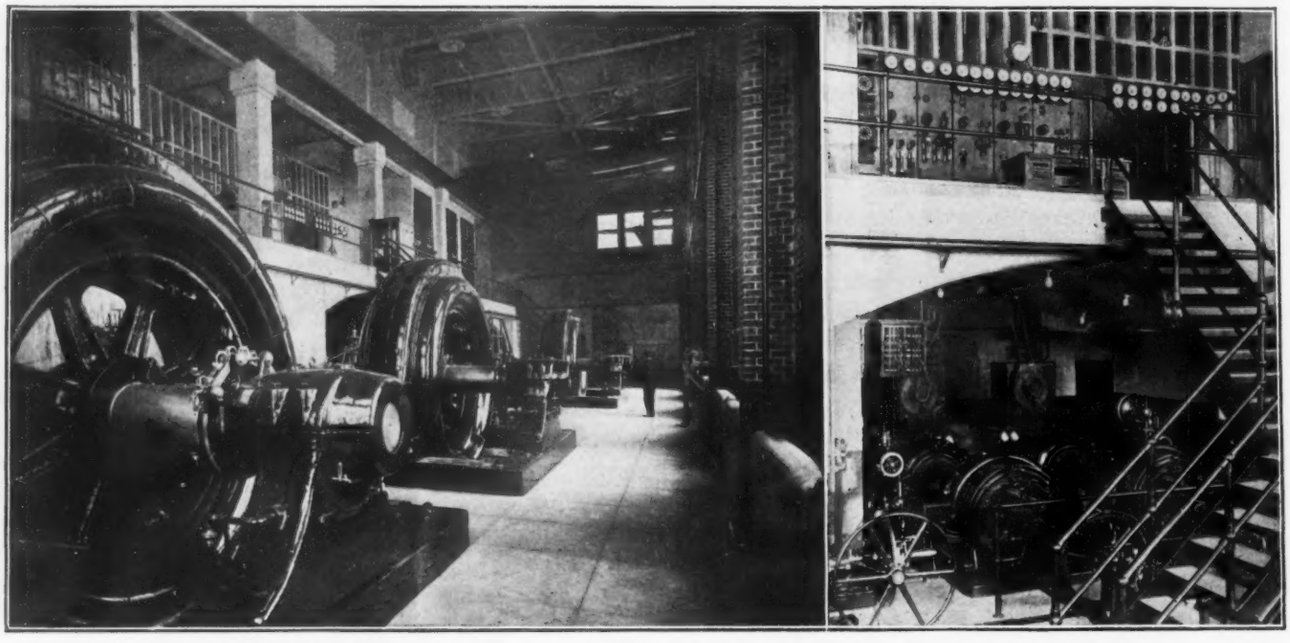
SLEET troubles on transmission lines and methods of preventing them on the Pennsylvania Water & Power Company's lines will be discussed in a leading article of the next issue, dated March 10. Other station and operating problems will also be taken up in that issue. In the third number of March will appear another section of Prof. Alfred Still's article on "The Design of High-Voltage Transformer Insulation," the first part of which was published in the Feb. 17 issue. Articles discussing commercial problems of special interest to central-station managers will be published in the March 24 issue. The fifth issue of March will contain a description of the electrical layout and operating features of a large New England cotton mill. Engineering features of other industrial installations and their operating problems will be discussed in the same issue. ELECTRICAL MERCHANDISING, which will be issued the fifteenth of March, will feature selling plans and methods of timely interest.

Construction and Operation of a Connecticut Hydroelectric System

Features of a 20,000-Hp. Station of the Connecticut Power Company at Falls Village Having Transmission Facilities for Supplying Energy to Connecticut Utilities and Exchanging Energy with Hartford Electric Company

THE Falls Village hydroelectric plant of The Connecticut Power Company, which is located in northwestern Connecticut on the Housatonic River, furnishes an interesting example of how irregular stream flow can be utilized economically by operating in conjunction with steam plants. In this case, however, the hydroelectric plant was developed as an entirely independent source of energy, arrangements being made later with neighboring systems for interchange of surplus energy. Reduced to a basis of horsepower per square mile of drainage the Falls Village plant is very highly developed, but the rating is justified in view of the auxiliary sources of energy connecting with the system. Energy is supplied to 6600-volt transmission lines reaching the towns of Millerton, N. Y., and Canaan, Norfolk, Lime Rock, Falls Village and Sharon, Conn., while 66,000-volt steel-tower lines run to Torrington, Thomaston, Bristol, New Britain and Hartford, Conn. Connections will eventually be made with the Middletown steam station of The Connecticut Power Company thereby tieing together the Housatonic and Middletown divisions of this company and affording the advantages of diversity in load and interchange of energy. The lines to Torrington, Bristol, New Britain and Hartford also furnish auxiliary sources of energy, since they connect with steam stations of the Torrington Electric Light Company, the Bristol & Plainville Tramway Company, the United Electric & Water Company and the Hartford Electric Light Company. Through the two last-mentioned companies, connections are virtually maintained with the Housatonic Power Company and many flourishing industrial communities of central Connecticut. To include all sources of energy connected to the system it should be pointed out that a small hydroelectric plant, also on the Housatonic River, is located at Canaan. This was formerly the generating station of the Berkshire Power Company, but is now the property of The Connecticut Power Company.

Falls Village was selected as the site of the hydroelectric plant because the contour of the Housatonic River was particularly desirable at this point, two falls, Little Falls and Great Falls, giving a hydraulic drop of 110 ft. Attempts had been made as early as 1850 to utilize the natural head thus available by building dry-masonry canals, but due evidently to the seepage of water they were abandoned without ever being used. One of these canals was, however, utilized in the present plant, and extends from Great Falls about 2000 ft. downstream, having an overflow spillway near the headworks and also at its lower end.



FIGS. 1 AND 2—GENERATOR ROOM AND SECTION OF SWITCHING GALLERY OVERLOOKING GENERATOR ROOM

In laying out the present plant several schemes of utilizing the Housatonic River were considered. The one adopted required cutting a channel through Little Falls barrier and constructing a dam at Great Falls with its crest at the elevation of the Little Falls barrier. In addition the old canal was utilized with the addition of a reinforced concrete lining and walls raised approximately 4.5 ft. Extending the walls of the canal to any higher elevation by building on the old wall was considered unsafe, consequently the crest of the dam is 9 ft. higher than the canal spillway and the level of the water in the canal is controlled by motor-operated regulating gates, which may be controlled at will of the switchboard operator either by hand or by an automatic float located in the canal.

Two methods of conveying the water from the canal to the power house were considered. One involved penstocks approximately 800 ft. long, utilizing the maxi-

mum natural load; the other, which was adopted, uses penstocks approximately 400 ft. long, and required excavating the channel of the river for the tailrace in order to utilize part of the 4 ft. additional drop in the rapids below the power-house location. The selection of the power-house site was based on comparison of the costs of the two schemes and a study of the comparative regulation of the two lengths of penstocks.

The drainage area above Great Falls is 644 square miles and the pondage about 21,000,000 cu. ft., equivalent to about 243 second-feet for twenty-four hours. Although there are several small pondages above Falls Village, the largest is that of the Canaan plant, 6 miles up the river. Since the control of this pondage is essential to the successful operation of the Falls Village

HYDRAULIC DATA FOR HOUSATONIC RIVER AT FALLS VILLAGE

Month	Year	Discharge (Cu. Ft.-Sec.)			Rainfall (In.)	Ratio Run-off to Rainfall (per cent)
		Max.	Min.	Mean		
January	1913	3020	1290	2300	4.02	102.3
	1914	1600	200	513	2.51	36.7
	1915	2690	**35**	1114	5.77	34.5
February	1913	1770	588	1248	2.28	88.5
	1914	1800	350	721	2.35	49.9
	1915	**5850**	840	2026	5.54	59.2
March	1913	**8110**	825	2705	6.05	80.0
	1914	**8520**	400	2390	4.23	101.2
	1915	2760	512	884	0.12	....
April	1913	4410	1050	2416	4.02	104.0
	1914	5680	2750	3825	3.65	179.6
	1915	3120	432	1114	2.56	75.4
May	1913	1970	440	915	4.13	39.8
	1914	3430	480	1830	3.25	99.0
	1915	920	356	614	2.9	38.0
June	1913	1250	178	536	1.81	51.4
	1914	696	220	407	2.87	23.9
	1915	560	154	332	4.65	12.5
July	1912	440	145	275	2.90	11.4
	1913	328	80	193	1.45	23.4
	1914	570	208	306	3.10	17.7
	1915	4480	339	1427	7.97	32.0
August	1912	803	169	321	4.27	13.3
	1913	214	80	157	4.59	6.1
	1914	392	190	255	2.48	18.5
	1915	3320	529	1320	7.41	31.8
September	1912	576	182	316	3.08	17.8
	1913	297	**72**	181	3.74	8.3
	1914	252	136	196	0.55	61.8
	1915	1090	350	605	3.74	28.1
October	1912	**2960**	**91**	591	4.51	23.3
	1913	4510	154	726	8.88	14.7
	1914	169	**24**	122	2.23	9.9
	1915	725	193	450	1.96	41.3
November	1912	2800	632	1179	3.69	55.3
	1913	2020	538	988	3.23	52.6
	1914	160	29	117	2.37	8.4
	1915	855	193	440	2.07	36.7
December	1912	1990	91	1408	4.86	51.9
	1913	1550	619	912	2.54	64.2
	1914	157	86	131	2.58	8.9
	1915	5670	220	1735	8.89	35.0

plant, this property was acquired by The Connecticut Power Company in 1912. The acquisition added enough pondage to that already available at Falls Village to make a total of about 42,000,000 cu. ft., or the equivalent of 486 second-feet for twenty-four hours. With this large pondage the flow may be utilized so that the minimum output of the development is not affected by the low Sunday flow caused by the shutting down and storing of water by the mills located on the river above Great Falls.

The normal head at the Canaan plant is approximately 12 ft., but during extreme high water is reduced to only a few inches. A 250-hp. steam auxiliary has therefore been installed in this station for use during periods of extreme high and low water, arrangements being made as described on page 1251 of the Dec. 23, 1916, issue of the ELECTRICAL WORLD for operating the waterwheels at reduced head. As an auxiliary to the Falls Village station the Canaan plant will not be required at times of high water, and at times of low water it will operate under maximum head at its highest efficiency and materially increase the output of the system.

The dam at Great Falls is 14 ft. high and 320 ft. long. Next to the headworks is a skimming gate through which large pieces of ice and floating material

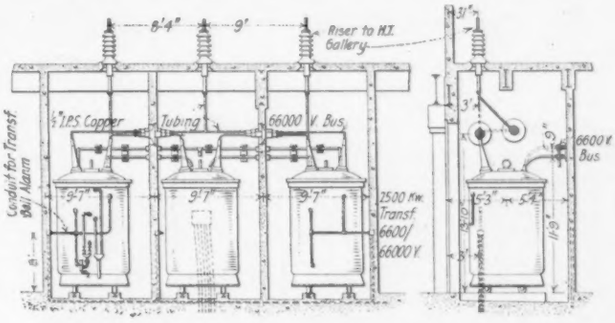


FIG. 3—ARRANGEMENT OF BANK OF TRANSFORMERS IN SEPARATED FIREPROOF COMPARTMENTS

may be diverted by a floating boom anchored to large boulders. Four gates are provided for admitting water to the canal, these being electrically operated and remotely controlled. The amount of gate movement is indicated at the station by the arrangements described on page 1007 of the Nov. 18, 1916, issue of the ELECTRICAL WORLD. Entrance to the gates is protected by 1.75 by 5.75-in. wooden bars spaced 6 in. center to center and extending up only to the water level. On account of the presence of the skimming gate, boom protection and submerged screen and consequent con-

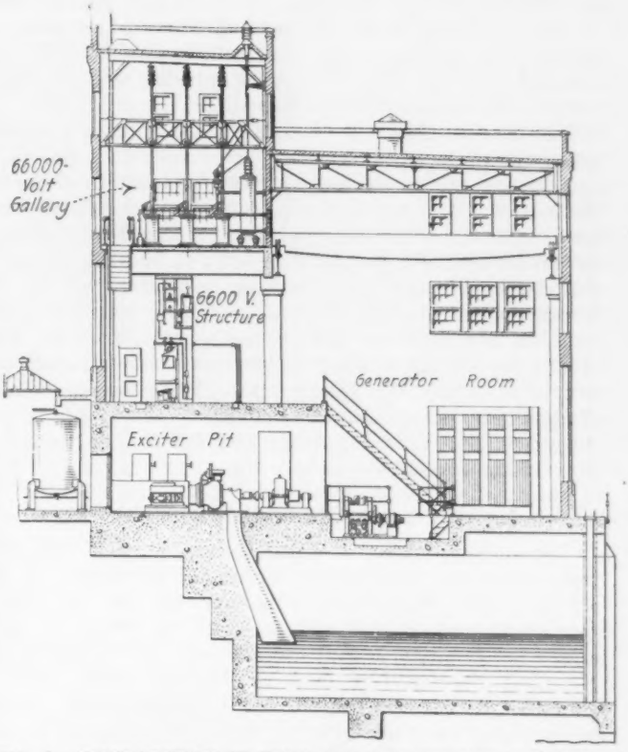


FIG. 4—CROSS-SECTION OF HIGH AND LOW-VOLTAGE SWITCHING GALLERIES AND EXCITER PIT

siderable depth of water above the headworks no serious ice trouble is experienced from the pond.

Directly below the headworks in the canal wall is a 260-ft. spillway, the crest of which is 9 ft. below that of the dam and 3 ft. below the top of the canal wall. The existing spillway was used to avoid the extensive excavation which would be required to bring it to the

proper level in case it were located in the main dam. To prevent water flowing over the spillway except in emergencies particular care is taken by the station operator to regulate the amount of water admitted to the canal, its level, within certain limits, being indicated by lamps attached to electrodes immersed in the canal. Details of this scheme are also described in the Nov. 18, 1916, issue of ELECTRICAL WORLD, page 1007.

The canal was constructed by excavating the old

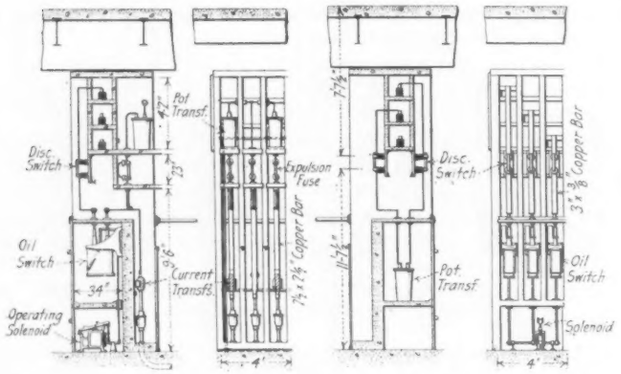


FIG. 5—SWITCH AND BUS-TIE SECTIONS OF 6600-VOLT BUS STRUCTURE

canal, utilizing the old rock walls for supporting one side of the canal, and lining it with reinforced concrete. Its minimum area of cross-section is 400 sq. ft., which permits a flow of 2500 second-feet with a maximum velocity of 6.25 ft. per second. The loss of head is only a few inches. The canal approaches the penstock almost at right angles, and at the end of the canal is a spillway, skimming gate and mudgate. Owing to ice which forms in the canal breaking and massing around the penstock entrances, arrangements were made during the past summer for diverting it over the spillway and discharging it through a long wasteway into the river.

The forebay head block contains four main penstock gates which have hand-operated hoists, with provision for future motor drive. Screens similar to those at the headworks are provided. Considerable difficulty has been experienced in the operation of small waterwheels in the Housatonic River on account of the migration of eels, so double fine mesh screens are placed at the entrance to the exciter penstocks. Three 9-ft. penstocks suitable for 5000-hp. waterwheels and two 3-ft. penstocks for 250-hp. exciter waterwheels are installed and provision made for one more main penstock. These dimensions will give a maximum velocity of 8.5 ft. per second in the main penstocks and 4.9 ft. per second in the exciter penstocks.

General Arrangements Inside Station

The station, which is located on the bank of the river just below the forebay, is arranged as shown in the accompanying plan and cross-section. In the middle bay on the main floor are the turbine-driven exciters, governor oil pumps, oil-storage tanks and heating plant. Mounted directly over each exciter are chain-operated rheostats actuated from the switchboard above. Space is provided on each side of the central bay for two 5000-hp. water turbine-driven generators with their corresponding governor mechanism, but only three units are installed so far. Since the turbines are horizontal-shaft, end-entrance units, rear-bearing inspection chambers are provided at the penstock ends.

Extending the whole length of the generator room along the penstock side is a gallery on the central portion of which, over the exciter pit, are the main switchboard and 6600-volt switch and bus structure. A telephone booth is so located at one end of the switchboard that an operator using the telephone can see every instrument and switch on the board. At each end of the gallery are separate fireproof compartments with metal doors for the transformers. Back of these is space for a machine shop, office, station-service equipment, storeroom and the like. All of the high-tension equipment—that is, the 66,000-volt apparatus, including oil switches, busbars, lightning arresters and disconnecting switches—is installed in a room over the gallery. The horn-gaps, however, are installed on a roof structure supporting the outgoing lines and are operated from within the station by pipe mechanisms.

Equipment Used in Falls Village Station

Falls Village—Three 5000-hp. double-runner Wellman-Seaver-Morgan waterwheels directly connected with 3000-kw. 60-cycle 6600-volt Allis-Chalmers generators running at 300 r.p.m. Lombard type-governors with automatically controlled oil pumps driven through magnetic clutches by constantly running induction motors. Two 250-hp. single-runner waterwheels directly connected with 150 kw. 125-volt exciters operating at 600 r.p.m. Two banks of water-cooled 6600/66,000-volt tranformers, each consisting of three 2500-kva. Allis-Chalmers transformers connected delta-delta.

The electrical connections are very simple, sectionalized buses with no duplications, loops, or transfer buses being used for both the 6600-volt and 66,000-volt circuits. Provisions are made for connecting one outgoing 6600-volt circuit, one bank of transformers and two generators to each half of the 6600-volt bus, so they may be operated in parallel or in two groups by closing or opening the bus-tie switch; however, only one of the outgoing circuits is connected so far. The 66,000-volt bus is similarly sectionalized, but two outgoing circuits are connected. All of the 66,000-volt oil switches are Westinghouse type E-3 while the 6600-volt switches are type GA. Four-cell type A electrolytic lightning arresters are connected with the 66,000-volt outgoing lines, and inverse time-limit relays are used with the outgoing line switches.

The transformers of each bank are installed in adjacent but separated concrete compartments with floors which are depressed and drained so oil will be carried away in case of transformer explosion and fire. Since the transformers are connected delta-delta simple ring-type buses can be used to join them. The 6600-volt bus-

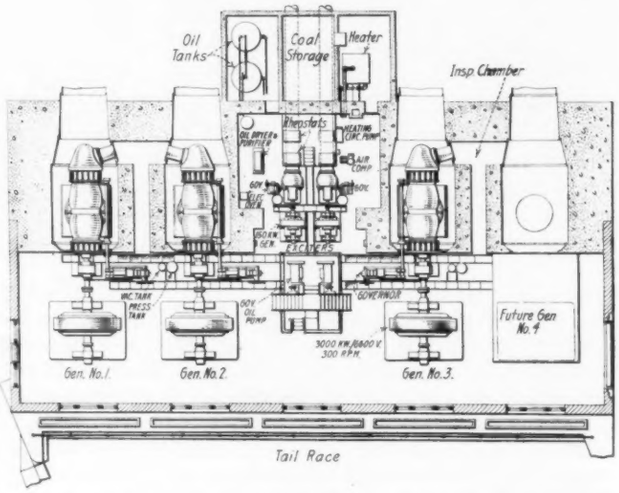


FIG. 6—LAYOUT OF TURBINE-DRIVEN GENERATORS, EXCITERS AND AUXILIARIES

bars consist of 1,000,000-circ. mil cable supported on Electrical Engineers Equipment Company's insulators No. 1886, and carried through the barriers in 14-in. Thomas wall bushings No. 7460. One-half inch copper tubing is used for the 66,000-volt connections being run through the compartment barriers in Thomas wall bushings No. 8403. From the low-tension bus cables run

down the wall through conduit and thence through the floor to the 6600-volt bus and switch structure. The 66,000-volt busbars, however, are connected with the high-tension buses on the floor above by copper tubing carried through Thomas floor bushings No. 8016. Thermometers, water-flow and oil-level alarm circuits on each transformer are inclosed in conduit, each branch of which terminates in a Crouse-Hinds condulet E-22. Between the conduits and the wall boxes (Burns No. 172), ¾-in. flexible conduit is used. The transformers are mounted on trucks and all piping and connections arranged so that the units can be easily withdrawn.

The 6600-volt bus and switch structure is built of concrete, the compartments on the side nearest the generator room being devoted to cable terminals, current transformers, potential transformers and their protecting fuses. The other side contains the oil switches, busbars and disconnecting switches. The arrangement of this apparatus is shown in elevations and cross-sections of the structure. A bus-tie section occupies the central portion of the structure, while the transformer, generators and feeder sections occupy about the same relative position that the corresponding apparatus occupies in the station. All the cable terminals are Electrical Engineers Equipment Company's type 50A potheads, while the current transformers are Westinghouse type KA.

As shown, the solenoids operating the oil switches are all mounted on the floor, permitting the oil switches to be placed above where they can be simply connected with their respective circuits. The busbars consist of two 3 by ¼-in. copper bars laid on edge on General Electric vertical insulators No. 42. Openings in the

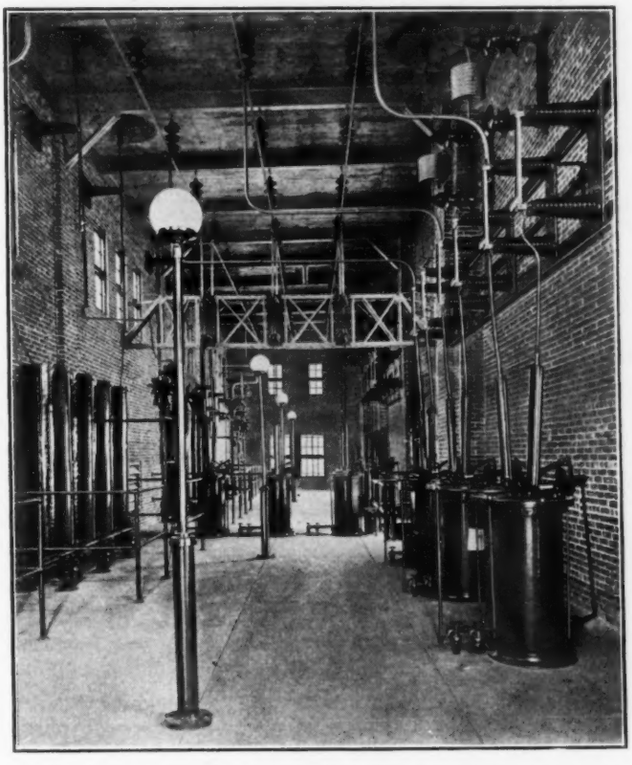


FIG. 7—HIGH-TENSION GALLERY SHOWING LINE SWITCHES, BUS-TIE SWITCHES, LIGHTING ARRESTERS AND OVERHEAD BUS

structure at the ends of the busbars are covered with asbestos lumber doors held in place by expansion bolts.

Symmetry of arrangement has also been carried out in the high-tension room. The busbars run along the ceiling, being sectionalized in the middle and brought down to bus-tie switches arranged across the room. Along the river side of the room are the lightning arrester tanks, fuses and risers leading to the roof bushings, operating rods for the horn-gaps on the roof, and risers from the transformers leading to the busbars with their disconnecting switches. Along the land side are line oil switches with their disconnecting switches and protecting choke coils.

The busbars, which consist of 1¼-in. iron pipe, are

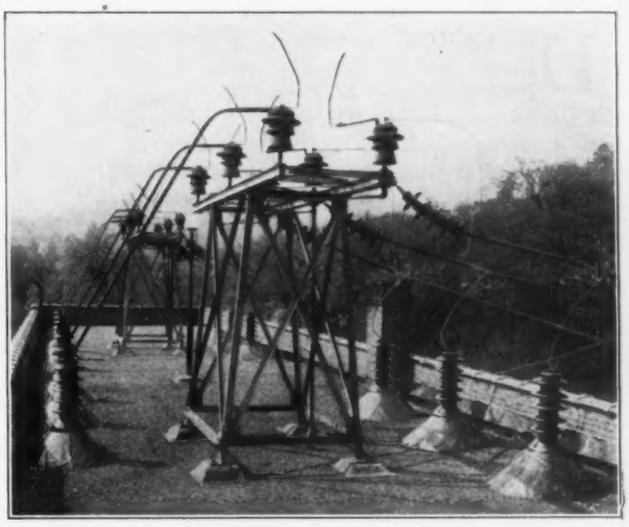


FIG. 8—ROOF STRUCTURES DEAD-ENDING OUTGOING LINES

supported by four-disk Pittsburgh suspension insulators No. 232 equipped with special hangers. The bus-tie disconnecting switches, which are equipped with post-type insulators like all the high-tension disconnecting switches, are attached to a truss directly over the bus-tie switches. The insulators supporting the transformer disconnecting switches as well as the posts insulating the lightning arrester risers and choke coils are attached directly to the brick walls, but the line disconnecting switches are attached to channels. It may be pointed out that all of the high-tension oil switches as well as the transformers are connected with oil-storage tanks and a filter press on the main floor, so the oil can be dried and cleaned without taking the apparatus out of service. The solenoids operating the switches are mounted on the floor, all wiring being run in conduit.

At the south end of the high-tension room is the lightning arrester equipment for the outgoing 6600-volt line. This consists of a choke coil in each phase and General Electric multigap arrester between each line and ground. The outgoing 6600-volt lines pass through Locke wall bushings No. 661 and connect with lines dead-ended to the building with Pittsburgh No. 232 insulators by means of Ohio Brass clamps No. 10,755.

Connections between the 66,000-volt lightning arresters and horn gaps and between the line switches and lines deadended on the roof structure pass through Thomas roof bushings No. 8016. The roof structure carrying the horngaps with the method of deadending the lines are shown in an accompanying illustration. It may be pointed out that arcing horns are attached to the 66,000-volt dead-end insulators.

This system was constructed under the plans and supervision of the Stone & Webster Engineering Corporation and is operated by the Stone & Webster Management Association. M. L. Sperry is district manager of The Connecticut Power Company, Henry E. Lyles is division manager of the Housatonic division and J. K. Mackie is superintendent of the Falls Village plant.

Features of the transmission system and an explanation of how the steam and water power stations are operated in parallel to the best advantage will be described in a later issue of the ELECTRICAL WORLD.

Entering an Age of Greater Electric Service

Defending Its Rates, the Union Electric Light & Power Company of St. Louis Shows That Development of New and Diverse Uses Is Costly, but Carries the Possibility of Further Economies in Unit Production Cost

DEFENDING its rates in a proceeding before the Public Service Commission of Missouri the Union Electric Light & Power Company of St. Louis expresses the belief "that we are entering upon an age of electric service." It "has voluntarily reduced its charges at frequent intervals to assist the greatest possible development in the use of electric service. It realizes that such development of new and diverse services is costly, but carries with it the possibility of further economies in unit production cost. It believes it is furthering both its own interest and the interest of the public in promoting such new uses and economies." It has followed this policy, notwithstanding its showing that its returns, all deductions properly considered, are lower than the percentage allowed by the same commission in a case affecting another company.

The proceeding which the company is contending follows a complaint made by the Engineers' Incitation Club, a voluntary organization of engineers engaged in the operation of steam plants, and others. The charge was made that the residence rate was "unreasonably high" and the power rate "unreasonably low," and that the rates were "ostensibly and colorably" affected by the contract for water power service with the Electric Company of Missouri. The commission was asked particularly to investigate the agreement for Keokuk power.

VALUE OF THE PROPERTY

On valuation the answer directs attention to the findings of the commission engineers on appraisal of the physical property of the Union Electric Light & Power Company, deducting property not used, being $22,599,195 cost of reproduction and $21,474,307 cost of reproduction less depreciation. These figures relate only to physical property and do not include cost of organization, development cost, going value or working capital, all elements of value which have been considered by the commission in other cases. A valuation made by the company in accordance with the order of the commission shows $24,974,638 for cost of reproduction of the physical property and $24,202,080 cost of reproduction new depreciated. The engineers of the commission have not yet submitted an appraisal of the property of the National Subway Company of Missouri or the Electric Company of Missouri, used and useful for St. Louis service. The valuation made by the company shows the following estimated costs of reproduction: Electric Company of Missouri, $1,532,708; National Subway Company, $446,601.

Accountants for the commission reported that the net profit on operations of the Union Electric Light & Power Company for the year ended Dec. 31, 1915, was $1,428,986. This amount, however, the accountants stated, was subject to adjustment by a proper allowance for reserves for insurance, relief and pensions, injuries and damages, law expenses, public service commission expense, amortization of intangible items and depreciation of plant and equipment, automobiles, horses and wagons. The accountants reported, furthermore, that in considering the amount of revenue which the company should receive from the public, the commission should allow, in addition to operating expenses, depreciation and return on investment, an amount sufficient to cover amortization of funded debt discount and expense. The accountants show that only $306,833 was reserved for depreciation in 1915, whereas in prior years the reservation was as much as $635,623. Engineers of the commission reported an estimated annual allowance of $783,828 to cover depreciation, and this did not include an amount necessary for the amortization of intangible items representing cash necessarily invested in the conduct of the business but not physical values. The amount sufficient to cover amortization of funded debt discount and expense was reported at $53,254.

The maximum rate in 1912 was 12 cents per kilowatt-hour. It was reduced until in June, 1916, the rate was 8.5 cents, and since the date of the report there has been a further reduction to 8 cents.

Net profits from operation for 1915, without the allowances and reductions indicated, were as stated, for the Union Electric Light & Power Company, $1,428,986; for the Electric Company of Missouri (water-power division), $265,872; National Subway Company of Missouri, $13,131; total, $1,707,989. Deducting only the loss in revenue which would have resulted in 1915 because of reduction in rates of the Electric Company of Missouri to the United Railways Company of $68,750, and the reduction in maximum rates from 10 cents prevailing until Dec. 15, 1915, to 8 cents now, conservatively estimated at $160,500, if applied to 1915 business, the net profits from operation would be reduced to $1,578,739.

The original cost as found by Price, Waterhouse & Company, accountants, prior to 1904, which is corroborated by the adjudicated value of the United States Court of Appeals in the Morgan Jones case, and as found by this commission's accountants since 1904, was as published in the accompanying statement:

	Original Cost For		Total
	Tangible Property	Intangible Property	
Union Electric Light & Power Co. Prior to 1904	$11,633,850	$4,104,429	$15,728,279
1904 to 1915	11,936,982	2,726,858	14,663,840
	$23,560,832	$6,831,287	$30,392,119
Electric Company of Missouri (water power division)	1,052,891	.....	1,052,891
National Subway Company of Missouri	561,161	.....	561,161
	$25,174,884	$6,831,287	$32,006,171

RETURN ON THE VALUES

Upon the total original cost the net profits from operations available for proper additional reserves as pointed out by the commission's accountants, for contingencies and surplus and for revenue adjustments because of rate reductions subsequent to 1915, were 5.336 per cent. Deducting the estimated amount of such rate reductions the net profits were 4.932 per cent of original cost.

Upon the cash investment in physical property, neglecting expenditures necessary and reasonable in the conduct of the business and of benefit to customers, the net profits available for all of the purposes enumerated were 6.784 per cent before deducting the effect of rate reductions since 1915 and 6.271 per cent after such deduction.

Costs of reproduction of the physical property, as found by the commission engineers for the Union Com-

pany, and as found by the company for the Electric Company of Missouri and the National Subway Company, and used in the absence of such report by the commission engineers were: Union Company, $22,599,195; Electric Company (water-power division), $1,532,708; National Subway Company, $446,601; total $24,578,504. Upon such costs, without adding any appraisal of cost of organization, going value, development cost or working capital, the net profit was 6.949 per cent before deducting the effect of rate reductions since 1915 and 6.423 per cent after such deduction.

EFFECT OF SUGGESTED RATE

In lieu of the present alleged discriminatory rates the complainants suggested "a uniform rate of not over 5 cents per kilowatt-hour for the first 120 hours' use per month of installed capacity, and all use in excess thereof at 2.5 cents per kilowatt-hour." The average rate in 1915 was 7.67 cents, in 1916 6.61 cents, and at present it is estimated conservatively at 6.12 cents. The maximum rate applies to less than thirteen hours' use of the installed capacity, and a rate of 3 cents gross per kilowatt-hour is earned after less than twenty-five hours' use per month of the installed capacity. To charge 5 cents per kilowatt-hour for 120 hours' use of the installed capacity would penalize every user of domestic appliances. While it would result in a small reduction from residence customers for lighting only, it would do so at the expense of an increase in the monthly bill of a residence customer using an electric flat-iron and range of over 39 per cent. "The proposed rate in the complaint," the company adds, "could not have been more advantageously designed had its purpose been to promote a 'cook with gas' campaign."

A separate report was made by the commission accountants upon the rates applied to isolated plants, the low charges to which were the basis of the complaint. Their report on Union Company accounts showed the following results of operation of isolated plants for the year ended Dec. 31, 1915: Sales of electric energy and steam, $424,621; expenses, $287,481; net profit, $137,140. The accountants added to the actual cost of operating the plants themselves an amount representing cost of the energy furnished from the main lines to consumers in isolated plants figured at the cost of production, 0.533 cent per kilowatt-hour. To this figure, they said, should be added a portion of the cost of transmission and transformation, distribution, commercial and new business, general and other expenses, which they were unable to pro rate. The company concludes: "It is apparent that the net profit of $137,140 is sufficient to pay operating costs and fixed charges of over $1,000,000 of investment," and "that no such investment is used and useful in supplying such isolated plants."

CLASSIFICATION NECESSARY FOR DIVERGENT USES

The readiness of the company to support its rate-making is expressed as follows: "We are prepared to substantiate on hearing, should such prove necessary, that the rates charged by the defendant company are not discriminatory; that the classification adopted is reasonable and places in each of the separate classes all the customers served alike and contemporaneously and under the same or substantially similar conditions; that such classification is necessary to care for the divergent uses and character of electric service demand and for the greatest development of such use; that such classification is far simpler than that obtaining in other large cities in the United States serving a similarly diversified character of business; that the rates resulting from such classification reasonably reflect the difference in cost incurred in serving such separate classes and do not result in any unreasonable prejudice or disadvantage to any particular class; that a single classification such as proposed by complainant of 5 cents per kilowatt-hour for the first 120 hours' used per month of installed capacity would do irreparable injury to the business in that it would increase rates for low-tension power service over 60 per cent, would increase charges for high-tension power service over 300 per cent, would increase charges for municipal street lighting service over 28 per cent, and would increase charges for direct-current lighting service, confined to the business section of the city, over 40 per cent, and would force such customers to use other and less satisfactory forms of lighting, power and heating; that such a schedule, or one similarly designed, would obliterate all of defendant company's efforts to bring the benefits of electric service with its labor-saving devices to the home and the workshop, and put an effective damper upon the movement, in which the company is now taking a large part, for making St. Louis a cleaner and brighter city; that such a rate schedule as that proposed would obliterate all possibilities of achieving that further economy in the conduct of the business which has come from longer hour use, more extensive and diversified use and large scale production, and which has resulted in such a cheapening in the charges in the past."

WATER POWER CONTRACT

The contention that power had been obtained through an intermediary or intermediaries, and that savings and benefits in the price of energy were diverted from the beneficiaries intended by Congress was disposed of by the returns actually earned, in which the accounts of the associated companies were included. Since then the Union Company has acquired the Electric Company of Missouri. Engineers of the commission, however, stated, after analysis of the cost of water-power energy under the contracts, that the effect thereof was to increase the cost of energy to the Union Company $412,818 in 1914 and $441,882 in 1915. "It appears, however," they add in their report, "from an examination of the Union Company's operating expenses for 1914 and 1915 that the company and not the consumer carried the burden of the water power contract."

These estimates of cost are based on a comparison of steam generation and water-power purchase prices, and the company is prepared to substantiate on hearing that they fail to take into consideration important elements, such as that imported power permitted delay in investments in equipment that would otherwise have been required. Through improvements in the art, equipment now being installed more nearly approaches ultimate efficiency and consequently has a much longer economical life in service with lower annual replacement costs.

On Dec. 31, 1915, the company had spent $45,207 in preparing the inventory of its physical properties in accordance with the commission order in this case. About $22,973 of this total is estimated as the value of permanent office records resulting from such inventory. The State has also incurred substantial expense.

Estimates of values by the engineers and accountants of the commission were accepted by the company only for the purpose of its motion that the complaint be dismissed. The company does not admit that the estimates are the full or true value of its properties.

HEARINGS TO PROCEED

St. Louis advices say that the petition filed by the company with the Public Service Commission of Missouri to dismiss the complaint of the Engineers' Incitation Club was denied upon the representation of the attorney for the complainant. He stated that the complainant's case had not yet been presented. The first hearing on the original complaint was set for March 19 at the request of the Union company.

Results of 1916 Light and Power Operations

Central Station Income from Energy Sales More Than $415,000,000, Output Considerably in Excess of 23,000,000,000 Kw.-Hr.

IN what was undoubtedly the largest industrial year on record the central stations of the United States increased their income from light and power sales by 15 per cent and delivered 22.5 per cent more energy to consumers. The earnings for 1916, according to the returns received by the ELECTRICAL WORLD, were more than $415,000,000 while the output was considerably in excess of 23,000,000,000 kw.-hr. The 1916 earnings were greater than those of 1915 by $54,000,000, and the increase in output was 4,265,000,000 kw.-hr.

December returns show the earnings in the last month of the year to have reached $41,000,000. The output was 2,190,000,000 kw.-hr. The increase in income over December, 1915, was 15 per cent, and in output 20.8 per cent. December established a record both for income and output.

In New England and the Middle West the December percentages of growth were somewhat less than those for the previous months. In the remainder of the country the percentages were greater. In the Middle West the income and output of one company were seriously curtailed owing to an accident at the power house. Such local conditions together with the fact that December, 1915, was a large month in the East and Middle West

TABLE I—CENTRAL-STATION RETURNS FOR TWELVE-MONTH PERIOD

	Percentage of Industry Represented	Income from the Sale of Energy			Kw.-Hr. Output		
		1916	1915	Per Cent Increase	1916	1915	Per Cent Increase
Jan.	65	25,286,000	22,352,000	13.2	1,200,672,000	984,205,000	22.0
Feb.	65	22,133,000	19,175,000	15.3	1,121,452,000	869,537,000	29.1
March	65	22,027,000	18,722,000	17.8	1,212,363,000	969,888,000	25.2
April	64	21,203,000	18,375,000	15.5	1,137,602,000	920,464,000	23.1
May	64	20,345,000	17,559,000	16.0	1,170,143,000	944,681,000	24.0
June	64	20,254,000	17,551,000	15.4	1,170,679,000	968,724,000	21.0
July	64	19,760,000	17,301,000	14.2	1,174,374,000	976,704,000	24.4
Aug.	64	20,502,000	17,861,000	15.0	1,262,575,000	1,015,805,000	22.4
Sept.	64	21,432,000	18,600,000	15.2	1,268,339,000	1,037,976,000	21.2
Oct.	64	22,882,000	20,164,000	13.5	1,347,502,000	1,125,132,000	19.9
Nov.	63	24,303,000	21,277,000	14.6	1,377,487,000	1,131,012,000	22.0
Dec.	55	22,579,000	19,614,000	15.0	1,207,713,000	999,323,000	20.8

TABLE III—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR UNITED STATES—CITIES GROUPED BY SIZE

	Mch.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
INCOME:										
Group 1	16.0	13.9	14.4	14.9	13.8	13.9	15.0	11.6	13.2	10.9
Group 2	18.5	17.0	17.5	17.7	16.8	15.7	20.4	19.2	17.7	16.5
Group 3	28.1	24.7	26.2	21.8	19.5	20.9	18.4	18.5	18.2	15.2
Group 4	17.3	17.4	15.1	11.0	9.0	9.5	11.3	13.5	12.8	13.8
Group 5	26.5	16.1	24.0	15.3	12.2	14.9	13.3	16.0	15.8	7.7
OUTPUT:										
Group 1	22.0	20.0	21.3	18.7	18.1	21.4	18.5	16.6	18.2	17.9
Group 2	28.1	25.5	18.0	17.5	22.9	33.0	32.9	31.1	27.2	22.0
Group 3	39.0	37.7	40.0	21.8	27.8	31.1	19.3	24.0	31.0	28.4
Group 4	18.2	22.7	23.0	19.3	16.1	23.0	26.0	20.4	19.7	25.0
Group 5	29.9	32.0	33.2	19.0	11.6	16.8	15.3	18.3	32.0	24.8

TABLE IV—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR NEW ENGLAND STATES—CITIES GROUPED ACCORDING TO SIZE

	Mch.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
INCOME:										
Group 1	21.5	16.0	17.0	16.4	12.6	9.6	16.5	12.1	13.5	12.5
Group 2	19.0	21.2	19.5	19.8	20.6	15.1	25.5	21.3	20.0	14.5
Group 3	38.7	15.5	24.0	18.2	21.2	15.0	20.5	18.0	19.4	16.0
Group 4	18.1	13.2	13.5	7.2	6.2	11.1	10.5	15.4	16.0	15.9
Group 5	54.5	27.6	27.0	21.7	14.9	17.5	18.3	18.2	16.3	11.0
OUTPUT:										
Group 1	30.9	25.0	28.2	30.0	19.2	31.3	34.0	17.5	18.0	10.8
Group 2	27.8	31.4	33.2	26.3	14.1	32.0	37.7	35.0	24.7	17.5
Group 3	49.0	38.1	43.0	15.0	31.4	45.5	32.4	42.6	35.9	19.8
Group 4	17.4	36.1	30.0	21.0	26.6	39.4	32.9	48.9	40.0	55.4
Group 5	58.7	71.8	54.4	31.7	13.5	21.3	27.4	22.0	44.4	43.0

TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A TWELVE-MONTH PERIOD

	Month	New England States			Atlantic States			Central States (Illinois Excluded)			Pacific and Mountain States		
		Percentage of Industry Represented	1916	1915	Per Cent Increase	Percentage of Industry Represented	1916	1915	Per Cent Increase	Percentage of Industry Represented	1916	1915	Per Cent Increase	Percentage of Industry Represented	1916	1915	Per Cent Increase
INCOME	January	66	2,819,000	2,432,000	15.0	67	9,589,000	8,564,000	12.0	57	7,834,000	6,717,000	16.6	88	4,182,000	3,823,000	9.4
	February	66	2,599,000	2,185,000	18.8	67	8,978,000	7,854,000	14.3	57	6,660,000	5,568,000	19.7	88	3,761,000	3,443,000	9.3
	March	66	2,595,000	2,122,000	22.0	67	8,998,000	7,660,000	17.5	57	6,470,000	5,394,000	20.1	88	3,787,000	3,386,000	11.9
	April	64	2,221,000	1,898,000	17.0	67	8,794,000	7,596,000	15.8	56	6,289,000	5,292,000	19.0	88	3,825,000	3,520,000	8.8
	May	65	2,103,000	1,788,000	17.0	67	8,226,000	7,131,000	15.4	56	6,085,000	5,123,000	18.7	88	3,874,000	3,469,000	11.6
	June	65	2,208,000	1,906,000	16.0	67	8,045,000	6,905,000	16.5	56	6,007,000	5,143,000	16.9	88	4,017,000	3,539,000	13.5
	July	65	2,130,000	1,875,000	13.7	67	7,832,000	6,621,000	16.4	56	5,926,000	5,095,000	16.3	88	3,755,000	3,493,000	7.6
	August	65	2,203,000	1,935,000	13.7	66	8,000,000	6,875,000	16.4	56	6,195,000	5,266,000	17.7	88	3,883,000	3,582,000	8.4
	September	65	2,315,000	1,982,000	16.8	66	8,631,000	7,445,000	16.0	56	6,505,000	5,537,000	17.8	88	3,979,000	3,644,000	9.2
	October	65	2,684,000	2,331,000	15.2	65	8,887,000	7,930,000	12.1	56	6,968,000	5,895,000	18.2	87	4,213,000	3,889,000	8.3
	November	65	2,904,000	2,511,000	15.7	65	9,821,000	8,634,000	14.4	55	7,170,000	6,088,000	17.8	86	4,234,000	3,937,000	7.5
	December	65	2,957,000	2,605,000	13.7	58	9,479,000	7,992,000	18.5	50	7,304,000	6,448,000	13.3	68	2,680,000	2,429,000	10.2
			1916	1915			1916	1915			1916	1915			1916	1915	
KW.-HR. OUTPUT	January	66	97,072,000	77,029,000	26.2	67	431,201,000	356,809,000	20.8	57	362,121,000	284,407,000	27.5	88	301,645,000	258,982,000	16.5
	February	66	92,855,000	68,982,000	34.8	67	411,715,000	320,924,000	28.1	57	339,326,000	252,816,000	34.1	88	268,653,000	220,662,000	22.1
	March	66	97,321,000	74,958,000	29.9	67	439,660,000	349,347,000	26.0	57	360,872,000	282,179,000	28.0	88	304,327,000	255,450,000	19.3
	April	64	84,769,000	64,816,000	30.8	67	403,223,000	326,574,000	23.4	56	344,866,000	273,357,000	26.4	88	302,386,000	253,778,000	19.2
	May	65	84,719,000	64,318,000	31.8	67	409,529,000	333,585,000	22.0	56	345,850,000	275,328,000	25.6	88	328,793,000	266,599,000	23.2
	June	65	87,829,000	69,506,000	27.6	67	396,630,000	327,541,000	21.2	56	350,015,000	288,982,000	21.2	88	328,996,000	277,915,000	18.6
	July	65	85,317,000	71,160,000	19.8	67	401,179,000	333,771,000	20.3	56	350,708,000	287,407,000	22.2	88	325,647,000	279,285,000	17.4
	August	65	97,197,000	72,900,000	33.4	66	433,129,000	344,730,000	25.7	56	374,327,000	295,866,000	26.5	88	333,468,000	279,976,000	19.1
	September	65	98,350,000	73,343,000	34.2	66	446,534,000	369,815,000	20.8	56	387,626,000	307,485,000	26.2	88	335,817,000	288,332,000	16.4
	October	65	107,756,000	83,705,000	28.8	65	426,151,000	373,705,000	14.2	56	408,364,000	324,509,000	25.9	87	355,014,000	306,828,000	15.8
	November	65	111,615,000	88,901,000	25.6	65	522,390,000	414,757,000	26.0	55	407,733,000	327,078,000	25.0	86	346,675,000	293,378,000	18.2
	December	65	109,524,000	90,952,000	20.5	58	459,947,000	390,792,000	28.0	50	400,711,000	333,080,000	20.2	68	226,437,000	175,635,000	29.0

TABLE V—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR ATLANTIC STATES—CITIES GROUPED BY SIZE

	Mch.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
INCOME:										
Group 1.....	16.7	15.1	14.5	16.4	16.8	16.1	16.2	10.7	13.7	19.0
Group 2.....	21.2	81.5	21.7	21.9	18.5	21.6	19.0	21.0	22.5	21.7
Group 3.....	20.5	15.3	17.7	12.0	14.2	15.0	14.0	14.6	13.0	13.2
Group 4.....	17.9	19.5	14.0	15.4	10.0	14.4	9.8	13.5	13.1	16.4
Group 5.....	12.2	15.6	13.0	15.2	13.0	19.4	8.9	14.3	16.0	14.3
OUTPUT:										
Group 1.....	29.2	26.1	25.5	13.1	23.4	28.5	23.6	19.2	21.2	17.7
Group 2.....	25 6	35.6	11.3	31 8	27.4	32.5	26.7	33.0	31.9	28.2
Group 3.....	16.0	13.7	18.0	13.2	11.5	16.0	24.7	4.5	19.0	14.9
Group 4.....	20.9	19.0	12.6	19.7	16.3	29.5	18.6	17.5	14.6	17.6
Group 5.....	13 1	8.9	35.0	11.1	13.5	20.4	1.3	1.5	5.8	6.9

TABLE VI—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR CENTRAL STATES—CITIES GROUPED BY SIZE

	Mch.	April	May	June	July	Aug.	Sept	Oct.	Nov	Dec.
INCOME:										
Group 1.....	19.3	18.2	18.0	16.4	15.8	16.5	16.6	18.0	16.5	13.5
Group 2.....	19.1	18 0	17.4	17.5	17.3	21.8	21.5	21.0	17.0	16.4
Group 3.....	23.0	26 7	27.2	20.5	18.6	18.4	13.4	10.9	13.0	1.4
Group 4.....	22.9	22.8	24.1	17.5	17.5	10.7	20.0	19.7	16.8	17.0
Group 5.....	14.4	9.4	21.3	12.6	6.1	11.8	11.0	18.4	14.3	....
OUTPUT:										
Group 1.....	25.2	24.7	25.0	23.8	21.0	24.3	22.3	24.9	24.8	22.4
Group 2.....	32.3	23 9	19.5	12.3	25.7	36.4	40.0	31.7	29.7	21.9
Group 3.....	40.6	43.5	41.0	31.8	26 0	25.7	20.7	17.3	19.7	0.3
Group 4.....	31.9	39.2	38.5	34.3	21 1	23.0	33.8	26.1	21.2	21.7
Group 5.....	19.1	10.1	14.7	4.0	8.6	6.1	13.7	28.2	16.8	9.9

TABLE VII—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR PACIFIC AND MOUNTAIN STATES—CITIES GROUPED ACCORDING TO SIZE

	Mch	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
INCOME:										
Group 1.....	8.5	3.9	7.2	7.5	4.7	5.5	6.2	4.2	3.8	4.7
Group 2.....	18.7	3.5*	2.3	1.2	0.6*	0.7	4.9	1.3	3.0	3.6
Group 3.....	28.1	40 0	39.0	39.5	28.3	32.5	28.5	32.4	31.0	30.0
Group 4.....	17.5	11.7	13.8	3.6	1.0	0.5	11.5	7.2	0.4	0.9*
Group 5.....	26.3	12.0	19.1	12.8	13.2	13.0	11.7	13.5	17.1	11.1
OUTPUT:										
Group 1.....	22.7	8.0	12.0	8.0	10.0	6.3	7.1	5.2	7.7	12.0
Group 2.....	28.3	3.6*	2.2	1.0	2.0	6.5	7.8	9.7	11.4	8.7
Group 3.....	39.0	80.0	79.0	74.5	56.1	57.5	60.0	63.7	61.3	48.0
Group 4.....	18.6	10.3	21.8	10.0	4.0	7.5	12.0	*0.5	4.2	6.1
Group 5.....	30.0	11.7	17.5	16.0	10.8	16.5	7.0	14.7	42.3	5.1

*Decrease. †Results omitted owing to insufficient returns.

are in a large measure accountable for smaller percentages of growth in December, 1916.

The growth is still largely due to an increased power load. A very appreciable factor in this connection has been the scarcity of coal. Many isolated plants were threatened with complete shutdown unless they accepted central station service. Practically every section of the country seems to have felt this shortage. In some cases the central stations viewed the diminishing coal pile with no little fear. Many stations that had contracts covering a long period were forced to go into the open market and buy whatever they could at the prevailing prices.

This was but one of the increases in operating expense of central stations in 1916. Labor supplies and repairs were considerably more costly in 1916 than in previous years. Therefore in spite of the large gain in gross income, as shown by the accompanying figures, it is doubtful if there will be much if any gain shown in the figures for net income.

The growth of the industry from an output of 1,500,-

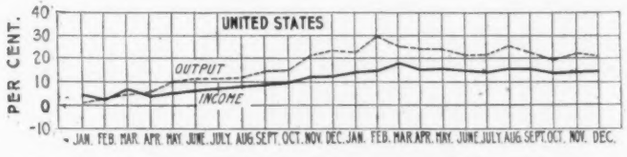
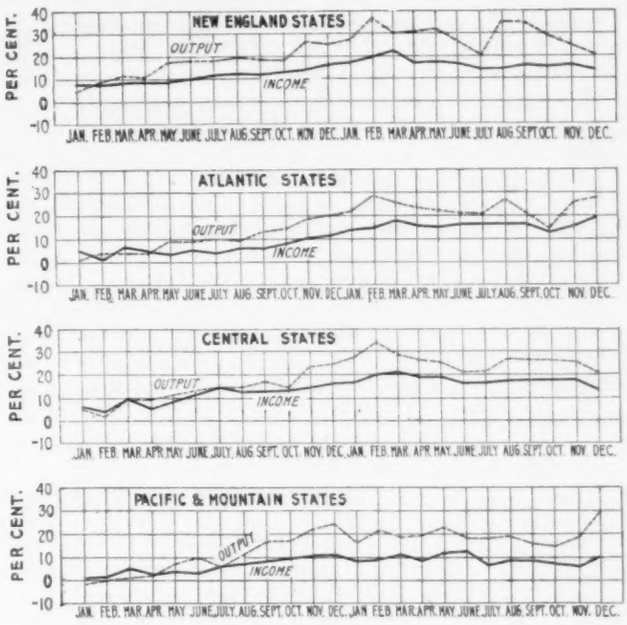

UNITED STATES
PER CENT.
OUTPUT
INCOME
JAN. FEB. MAR. APR. MAY. JUNE. JULY. AUG. SEPT. OCT. NOV. DEC. JAN. FEB. MAR. APR. MAY. JUNE. JULY. AUG. SEPT. OCT. NOV. DEC.

FIG. 1—CENTRAL STATION INCOME AND OUTPUT GAIN BY MONTHS IN PER CENT FOR UNITED STATES



FIGS. 2 TO 5—CENTRAL STATION INCOME AND OUTPUT GAIN BY MONTHS IN PER CENT SECTIONALLY

000,000 kw.-hr. in January, 1915, to one of 2,200,000,000 kw.-hr. in December, 1916, shows how well the industry has kept step with industrial progress. A glance at the accompanying curve showing the monthly income and

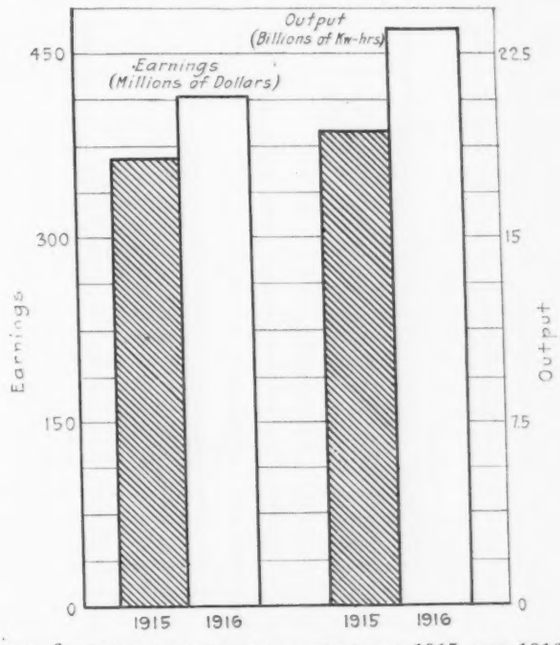


FIG. 6—TOTAL INCOME AND OUTPUT FOR 1915 AND 1916

output for 1915 and 1916 will show how the demand for light and power kept step with the demand for manufactured products. In 1915 there was a tremendous growth in monthly output. In 1916 the monthly output

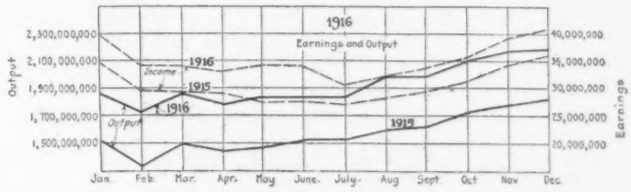


FIG. 7—VARIATION IN MONTHLY INCOME AND OUTPUT FOR 1915 AND 1916

was about the same until the last quarter when a spurt was taken.

The accompanying curves, Nos. 1-5, show graphically the percentages of growth in income and output as contained in Tables I and II. The remaining tables show the percentages of growth in income and output for companies grouped according to the size of the community served. Group 1 contains those companies operating in cities of more than 100,000 inhabitants, group 2 in cities with a population between 50,000 and 100,000; group 3, between 25,000 and 50,000; group 4, between 10,000 and 25,000 and group 5 between 5000 and 10,000. Fig. 6 shows graphically the total income and output for 1915 and 1916. Fig. 7 shows the variation in the monthly income and output for 1915 and 1916.

DATA ON THE DESIGN OF IRON-WIRE RHEOSTATS

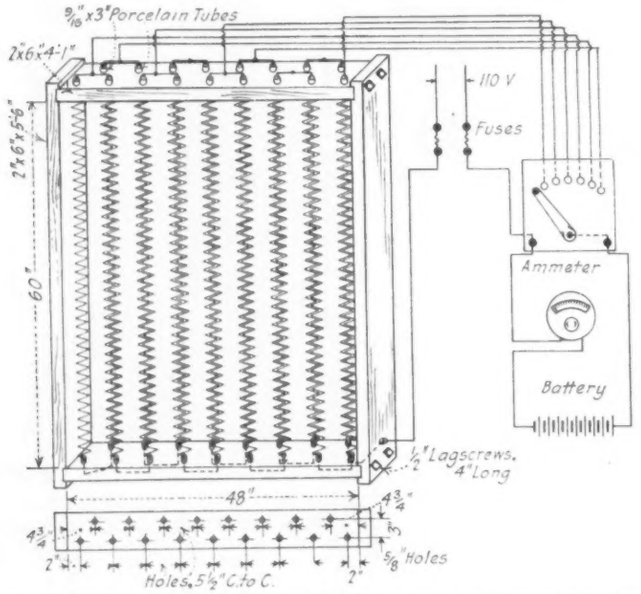
Considerations Involved in Designing and Constructing a Rheostat and Data That Facilitate Calculations

BY G. E. RUDOLPH
Electrical Construction Engineer, Custar, Ohio

The writer has recently designed a simple and inexpensive rheostat for use when charging storage batteries, the resistance elements of which are made of iron wire. The size of wire to use was determined by means of the formula

$$d = 3\sqrt{\left(\frac{I_m}{.014}\right)}$$

where d is the diameter of the wire in mils, and I_m the maximum allowable current. Calculations made therewith apply to iron wire only and permit a maximum temperature of 100 deg. C. Since 10 amp. was the maximum charging current to be allowed in the particular case referred to, the minimum diameter of wire which could be used, according to the formula, was 79.9 mils.



CONSTRUCTION OF IRON-WIRE RHEOSTAT FOR BATTERY CHARGING

This corresponds to No. 14 Roebling or American Steel & Wire Company's gage.

The total resistance required was computed by Ohm's law, $R = \frac{E}{I}$, E being the difference between the applied voltage and the back emf. of the battery; and I the minimum charging current or finishing rate which is allowed. For the case being considered the applied voltage was 110 volts and the back emf. about 18 volts, so the potential drop E across the rheostat had to be 92 volts. Since 4 amp. was to be the finishing rate of charging, the total resistance calculated by Ohm's law was 23 ohms. Since No. 14 iron wire runs about 81.38 ft. per ohm, and weighs 0.01697 lb. per foot, about 1872 ft. or 32 lb. were required for the complete rheostat.

For convenience in spacing the coils it was decided to use seventeen coils as an odd number can be arranged better than an even number. One hundred and ten feet of wire were therefore required per coil. Winding of the coils was facilitated by chucking a 3-ft. piece of 1-in. gas pipe in a lathe and turning it slowly so the wire could be wound on it evenly and closely. To obviate actually measuring the wire for each coil the space which would be occupied on the pipe by the correct amount of wire closely wound was computed in advance.

TABLE I—DATA FOR USE IN DESIGNING IRON-WIRE RHEOSTATS

No. Roebling Gage	Diameter in Inches	Safe Capacity in Amperes	Pounds per Foot	Feet per Ohm at 100 deg. Centigrade	Ohms per in. of Spiral Wound on 1-in. Gas Pipe
4	.2253	47.35	.1346	645.40	.0023586
5	.2070	41.70	.1136	544.83	.0030409
6	.1920	37.25	.09877	468.73	.0038108
7	.1770	32.96	.08307	398.35	.0048642
8	.1620	28.87	.06961	333.70	.0063869
9	.1483	25.29	.05832	279.64	.0082698
10	.1350	21.96	.04832	231.73	.010963
11	.1205	18.52	.03850	184.63	.015774
12	.1055	15.17	.02951	141.52	.022971
13	.0915	12.25	.02220	106.45	.035209
14	.0800	10.02	.01697	81.38	.052678
15	.0720	8.55	.01375	65.91	.072265
16	.0625	6.92	.01036	49.67	.11048
17	.0540	5.55	.007732	37.08	.17129
18	.0475	4.58	.005982	28.69	.25166
19	.0410	3.68	.004457	21.37	.39146
20	.0348	2.87	.003211	15.40	.63994

Since the temperature of resistance wires computed by the foregoing method will not exceed 100 deg. C. a wooden frame constructed as shown was employed for supporting the coils. Five-eighth inch holes were bored as shown in the top and bottom of the frame and bushed with 9/16 in. by 3 in. porcelain tubes to receive the ends of the resistance coils. By thus stretching the 26-in. coils to 60 in. the adjacent turns were separated sufficiently to prevent short-circuit. The ends of the coils protruding through the bushings were bent over and soldered to the corresponding terminal of the adjacent coil. Perhaps connecting diagonally opposite coils would have been better as in that way the maximum voltage between coils would only be about 11 volts whereas with the connections used it was almost the full voltage applied across the rheostat.

Where vibration is considerable or enough to cause the coils to short-circuit the mid points of each side of the frame can be joined by a 0.25-in. rod passing between the two rows of coils and covered with porcelain tubes. The coils can then be tied to the tubes.

The switch used in conjunction with this rheostat consisted of the slate top, switch blade and contacts of an old burnt-out motor starter. The points at which to connect the rheostat were found by experiment, it being the intention to make each change in the switch position allow two amperes change in current.

By means of the accompanying table, rheostats for any loads up to 50 amp. may be readily designed. For instance the size of wire can be obtained by comparing columns 1 and 3; the total resistance as explained before by Ohm's law; the total weight by multiplying the latter figures by the product of columns 4 and 5 and the length of spirals wound on 1-in. iron pipe by multiplying column 6 by the total resistance divided by the number of coils to be made.

Able Management—How to Get and Reward It*

A Company, the Public and the State Regulating Commission May Co-operate Wisely to Encourage Public Utility Efficiency and Stimulate Lower Rates by Increasing the Return as Charges Decline

BY SAMUEL W. FLEMING, JR.,
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A SECTION of the Pennsylvania public service company law states that it shall be lawful for every public service company to establish, with the consent of the commission, a scale of charges, subject to automatic adjustment, in relation to the dividends to be paid to the stockholders of such company; also to participate, to such extent as may be permitted by the commission and deemed wise by the commission, for the purpose of encouraging economies, efficiencies, or improvements in methods or service, in the additional profits which will be afforded by such economies, efficiencies, or improvements.

The Pennsylvania law thus definitely offers a way for rewarding ably managed utilities. A company that believes that it is entitled to recognition and reward for efficiency can go to the commission with a plan—for example, a sliding scale. The way is opened by law for the company to take the initiative.

Other states have similar clauses in their public service laws, such as Arizona, California, Idaho, Maryland, New York, Ohio and Wisconsin. Massachusetts also, through a special act, allows a sliding scale in the case of the Boston Consolidated Gas Company.

From the states mentioned it can be seen how widely the idea of rewarding ably managed utilities has found expression. Of these states Arizona, Idaho, California and Wisconsin say specifically that their commissions have the right to revoke at any time any plan of this character, even though the plan has been approved by them for a fixed period. In New York and Ohio, when a plan has been approved, the commissions apparently have not clearly the right to revoke such a plan till the end of the period for which it has been set. However, even where the right to revoke is not definitely incorporated in the law, it is not unlikely that a way would be found whereby the commission would revoke if it saw fit to do so.

GOOD FAITH OF COMMISSION

The protection for a utility whose plan had been approved lies in the good faith of the commission in carrying out its agreement, and this in the writer's opinion is a real protection. It cannot be assumed that a company and a commission would have settled hastily upon any such plan or agreed to it until their best thought and careful analysis had been given to it. The good judgment, as well as the good faith of a commission, could be seriously questioned if, after giving approval to run for a certain period, it should revoke this approval before the end of the period. Commissions were created for the protection both of public service companies and the public and it is doubtful if reasonable men on either side of a controversy really question the good intentions or impartiality of commissions.

Where a method to reward ably managed utilities is not incorporated in the law of a state it is implied, generally speaking, for every utility is entitled by law to a just and reasonable return for service rendered, and it would be proper for a commission to recommend, if necessary, an amendment to an existing act permitting the adoption of a plan to reward able management, which was the purpose of the application for a trial period of the so-called London sliding scale to the Boston Consolidated Gas Company.

Of course able management, in the eyes of the public and interpreted by commissions, means lower rates and improved service, which are proper if no injustice is worked on the company. The latter is expected to take the initiative and present the plan whereby its ability to lower rates and give good service may be rewarded equitably through its state commission. In this event the company co-operates with the commission to lower rates. In other words, the interested parties would always work for the same ends instead of sometimes trying to block each other.

It was in 1906 that a special committee, consisting of the Board of Gas and Electric Light Commissioners and two others appointed by the Governor, was created by the Legislature of Massachusetts to study the London sliding scale. As a result the Legislature passed a law, although the commission did not agree, allowing this plan to be applied to the Boston Consolidated Gas Company. Apparently one of the reasons why the Massachusetts commission was loath to approve the act was on account of the interference with its regular functions, for during the existence of the ten-year period the regulation of the Boston company has been carried out in accordance with the special law, putting it out of the ordinary control of the commission.

The procedure in the case of the other states noted above is much simpler, for the laws creating their commissions provide a definite method. The company may work out a system of rates subject to automatic adjustment in relation to dividends, or, if desired, another plan whereby the company may be allowed to participate in the economies and efficiencies which able management effects. A way is opened for a company that has confidence in its management; if, for example, it believes that a new power plant or new lines will improve service and lower costs it can go to the commission and ask that it be permitted to share in the economies anticipated from this expenditure. To be sure, the company is taking risks by assuming heavier obligations. Under present conditions of regulation the company, generally speaking, will be no better off than it is at present, for if higher dividends were earned their payment would not be permitted.

The stockholders of a utility and the consumers may be considered as partners; and as partners both should share in reasonable proportion in the results of the brains and achievements of the executives of the utility. One company may be able to sell energy for lighting service at an average of 6 cents per kilowatt-hour, while a nearby company operating under similar circumstances will be forced to sell for 7 cents. In the case of the former company such a difference might easily be due to better service, lower costs, more business and other matters, largely managerial, enabling it to offer lower rates. The company selling for 7 cents could very likely effect the same results and offer the 6-cent rate if the stockholders felt it worth while to procure a first-class manager and back him up by spending money for rehabilitation. But they argue.

*This is the second article by the author on this subject. The first article was published in the ELECTRICAL WORLD for Nov. 4, 1916, page 902.

"We are getting 6 per cent on our investment as it is, so why take chances by adding to our obligations when at best we will not be able to pay higher dividends and will be no better off than at present; at worst there may be miscalculation in design or estimates of future costs and we will be out of pocket."

With little stretch of the imagination the company which is able to sell for 6 cents per kilowatt-hour could be considered under existing regulation as having reached the limit of its possible expenditure from its viewpoint. This company might also go further in the way of improvements and reduction of rates, but, like the company now selling at 7 cents, it is not willing to run the risks of further investment when the present investment pays 6 per cent. Likewise the stockholders cannot see the advantage of adding to their obligations when their net returns will not increase and, due to miscalculations and errors in judgment or to increased costs of materials and labor, it may be that net earnings will be less.

Would an individual knowingly add to his obligations when such action would neither increase his net income nor add to his security?

In states where the way is open for a utility to present a plan to the commission for paying higher dividends as a reward for economies it might be advisable in many cases to take advantage of this opportunity with the view of not only adding to its net income, but also of stabilizing its public relations for a fixed period. As pointed out in a recent editorial in the ELECTRICAL WORLD, this is reason enough to find favor with operating men.

WHERE NEW INVESTMENT INCREASES PROFITS

The writer is familiar with the operation of a small electric company serving about 10,000 people. The cost of generating is approximately 1.5 cents per kilowatt-hour, the total business running not over 300,000 kw.-hr. There has never been an active campaign for new business, although there are splendid possibilities. The average rate for all energy is about 5 cents per kilowatt-hour and the company pays 5 per cent dividends.

If this property would spend $75,000 for a good power plant and distributing system, adding about one-third to the investment, it could cut costs and losses to such an extent that dividends of 7 per cent could be paid on the basis of the present output. Then by lowering rates and going hard after new business the output could be doubled within a year and 10 per cent net earned.

This is entirely possible, and careful estimates have checked it closely, but the owners of the property are conservative. They say frankly that they are afraid regulation will force a reduction in rates and they will not make an additional investment; further that they are getting some return on the investment, even though it is low, and they are not going to gamble on spending money. Who suffers? Primarily the members of the community, who might be getting better service at less cost; secondarily, the stockholders of the company, who might be getting a higher return on the investment.

This situation, which is a common one with utilities, brings the company to the point where it should present a "reward for able management plan" to the commission. In this event the utility and commission would work toward the same end—lower rates. If the utility, as at present, will not assume the financing to attain the results, neither it nor the public is benefited.

At present the Dallas Electric Company is taking up with the people of Dallas a new franchise offering rates based on a sliding scale. Likewise the Peoples Gas Light & Coke Company of Chicago is conferring with the city on a plan whereby consumers and stockholders will share in the profits. These are additional indications that the idea of rewarding able management is gaining recognition. If these companies and municipalities get together it is to be hoped that the state commissions will give their approval, assuming that the plans as submitted are sound, which, to judge from descriptions in magazines, they undoubtedly are.

Should not a commission be disposed to co-operate with a company to serve the public in this way?

In public hearings the good name and good intentions of a company are apt to be questioned, no matter how cleanly it may be managed, so that naturally utilities are usually unwilling to present any new plan to a public body involving such a radical change in rates as a sliding scale system. However, situations are arising where it would be timely to bring forward such a plan.

For example, in face of a threatened rate case it would be more economical for the public, the company and the commission to settle it without a long fight. A sound scheme presented at such a time, whereby a certain reduction in rates would be granted provided further reductions should permit higher dividends, might end the case in short order and promise stable relations for a term of years.

Again, a company might have passed very recently through a rate controversy, which always proves costly to the contestants. To stabilize future relations, a point which would be much appreciated, particularly at such a time, the company could present a plan to share with the public in future economies.

A third situation for timely action would be, as pointed out above, when the utility is reaching the limit of its power plant and distributing system, or have adequate though inefficient plant and distribution. In both instances the possible economies in operating costs, due to new investment, could be estimated closely. The public would benefit by lowered rates and the company by higher dividends, allowable if earned.

Within certain limits the benefits of a plan as suggested are cumulative. The more business a company acquires the lower the rates will likely be, both company and consumers working together. Industrial plants and individuals alike that contract for central station service can feel that by so doing they are benefiting the entire community, and that they in turn will benefit as additional business is acquired. This is somewhat like the situation in St. Louis and Milwaukee, where the electric companies are offering lower rates as the number of consumers increases.

DEFINITE ADVANTAGES

To summarize the advantages of a reward for able management plan, to the public, to the commission and to the utility:

1. The advantages to the public.
   a. Lower rates by a definite program.
   b. Better service.
   c. Less agitation and unrest in its relation with the company.
   d. Lessened need for expensive professional services necessary in contests with utilities before commissions.
2. The advantages to the company.
   a. Stable public relations for a fixed period.
   b. Co-operation with the commission instead of antagonism.
   c. Higher dividends allowed if earned.
3. The advantages to the commission.
   a. A definite policy.
   b. Tangible relations with the utility.
   c. The actual accomplishment of results for its clients—the public and the utility.
   d. Co-operation instead of antagonism on the part of the utility.

RECORDING WATTS AND VOLT-AMPERES SIMULTANEOUSLY

Construction and Operation of a Combined Graphic Wattmeter and Volt-Ampere Meter Developed in the Meter Department of a Central Station

BY HENRY H. LYON
Buffalo General Electric Company

A motor-driven, graphic-recording meter designed to give simultaneous graphic records of both watts and volt-amperes in a polyphase circuit has been developed by the writer and built in the meter department of the Buffalo General Electric Company. In general, the apparatus consists of a wattmeter, a reactive-component meter, a record sheet and a pulley-driven shaft connected through bevel gears with another shaft, each of which carries two magnetically operated friction clutches that drive worm screws. A 1/20-hp. induction motor, belted to the driving pulley, furnishes all the power required.

The electrical measuring elements are of the Kelvin balance type (Westinghouse graphic meter parts being used) so connected to the circuit through transformers

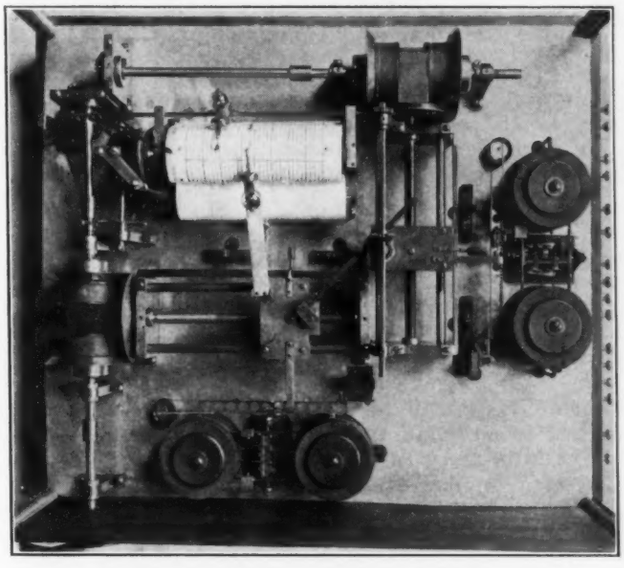


FIG. 1—TOP VIEW OF COMBINED WATTMETER AND VOLT-AMPERE METER

as to be actuated in accordance with the true watts and the reactive component of the power circuit.

Referring to Fig. 1, the shaft shown at the left and the one at the top rotate continuously driving the beveled disks which are rigidly mounted on the shafts. When one of the electromagnets is energized the corresponding disk is drawn into contact with the disk mounted at right angles to it on the end of the worm-screw shaft, and rolling friction between the disks causes the screw shaft to rotate, the direction depending on which disks are in contact. The electromagnets on the left-hand shaft are energized by a contactor on the wattmeter which is at the bottom and the magnets on the top shaft by the reactive-component meter at the right.

Each worm shaft slides a brass carriage along guide rods. Attached to each carriage is an arm which moves a rolling weight along a small channel iron connected to the movable coil of its respective meter. Thus the carriage will assume a position where the rolling weight balances the torque of the meter, as under this condition the contacts are opened and the magnets de-energized. Screwed on the rod connecting the rolling weight with the arm is a smaller weight which is used to calibrate the meter.

Since the carriage at the left travels a distance proportional to the true watts in the circuit and the other carriage travels at right angles to this, a distance proportional to the reactive component in the circuit, the distance between certain fixed points on the carriages

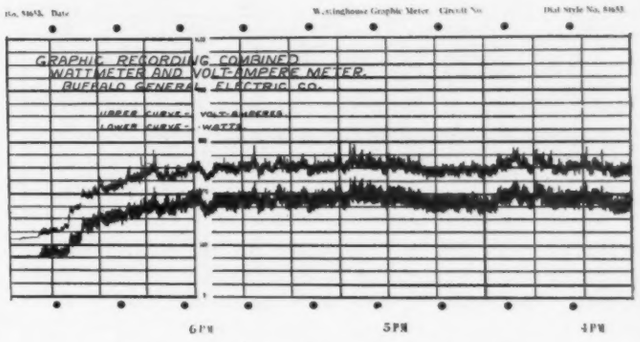


FIG. 2—GRAPHIC RECORD FROM THE METER

will be the hypotenuse of a right triangle and proportional to the volt-amperes in the circuit. A graphic record of this distance is obtained as follows: On the carriage at the left is mounted a non-rotatable pinion and on the other carriage is mounted a freely rotatable pinion. Held in mesh with the pinions, as shown, is a toothed rack. On the same shaft with the rotatable pinion and rigidly connected to it is a bevel gear which meshes with another bevel gear mounted on a square shaft so that it will slide along it as the right-hand carriage moves. The square shaft drives a toothed rack, carrying a pen which records the volt-amperes on the chart.

As the carriages move apart the rotatable pinion will be rotated by the toothed rack and turned a distance equal to the distance between the centers of the two pinions. Through the interconnected gearing the toothed rack is driven forward, a distance equal to the hypotenuse of the right triangle and therefore the pen attached travels across the chart a distance proportional to the volt-amperes in the circuit. A similar pen, mounted on the left-hand carriage, at the same time travels over the chart a distance proportional to the true watts. Circuit breakers are arranged to open the control magnet circuits, and prevent excessive travel of the carriages due to overload or other causes. One circuit breaker is arranged to open two control circuit magnets, and limit the travel of the upper pen, as this could be driven over the edge of the scale without either

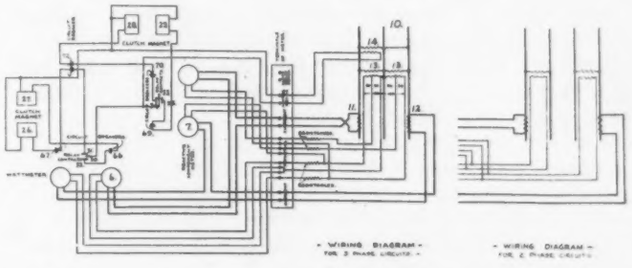


FIG. 3—DIAGRAMS FOR TWO-PHASE AND THREE-PHASE CIRCUITS

carriage having reached its limit of travel. The paper drum and the rewind roll is driven by the shaft at the extreme left. A relay operated by a contact-making clock causes an arm to punch small holes at the edge of the chart at regular intervals of time, thus giving an accurate indication of the time of the record and a check on the speed of the motor.

STATION AND OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

SELECTION OF INSULATORS

How Problems in Transmission Line Economies Are Being Analyzed for Operating Conditions in Minnesota

BY LINCOLN NISSLEY
Constructing Engineer, H. M. Byllesby & Company

One of the principal problems in transmission-line design is the selection of insulators for a particular service. Cheapness in first cost should not be the governing factor as maintenance and renewals, and the results of interruptions to service from insulator breakdown may more than offset any saving made in the initial investment. On the other hand it is usually advisable to pay the limit in initial cost of insulation for important lines of a system, rather than insulate only for normal conditions, as these are often exceeded. Conditions which may be given a numerical value may be taken into account in determining the relative values of insulators by the following formula:

$$Y_n' = (C - C_l)\, d_l\, W_n + (C - C_a)\, d_a\, (W_n' - W_n)$$
$$A_n' + Cr + O + M.$$

Where A = fractional life at the end of period of service
n = number of whole years
n' = period of service
L = life of insulator
C = first cost of insulator
C_a = salvage value at age A
C_l = salvage value at end of life
d_a = annual deposit in sinking fund to redeem $1 at the end of A years
d_l = annual deposit in sinking fund to redeem $1 at the end of L years
W_n = present worth of $1 per year for n years
W_n' = present worth of $1 per year for n' years
A_n' = annuity produced for n' years $1 principal
r = ratio of yearly interest and other fixed charges to first cost
O = yearly cost of operation
M = yearly cost of maintenance

Other data have a recognized bearing on the economic selection of insulators, but these cannot be expressed in dollars and cents. They are obtained by analyzing the performance of existing lines or studying the service given by different types of insulators installed to operate under similar conditions. Among the factors which should be considered are the causes of insulators failing, effect of ground wires, possibility of direction of line affecting insulator requirement, changes of stresses with weather conditions, probability of direct and indirect disturbance from lightning strokes, etc.

Although ground wires are in disfavor with some engineers the Byllesby companies still adhere to using them since experience in Minnesota has proved that they afford some protection. In that state, due to level topography, the clouds float relatively low, so the lightning discharges to earth are much shorter than in hilly or mountainous country. From over 2000 observations made in the districts covered by the Byllesby system, the storm clouds were about 800 ft. above the ground. Owing to the low elevation above sea level (700 ft.), corona problems could be neglected since the loss therefrom is relatively small as compared with that in higher altitudes. By more than 1000 observations on right-of-ways and according to the law of probabilities the percentage of direct lightning strokes on the line was found to be very small—less than one-fifth of 1 per cent. Where lightning has been the cause of interruptions to service, it has usually been found that the lightning struck 400 to 500 ft. away and that the line disturbance was caused by induction. Studies are now being made to determine why one of the transmission lines running 35 miles north and south is practically free from interruptions while other lines constructed in the same manner but running east and west and southwest give more trouble. It is peculiar to note that the line giving the least trouble runs across glacial moraines and attains the highest elevations of any of the circuits operated by the company.

Possible Serious Results When Fuses Fail to Blow

BY E. C. PARHAM

If the fuses of an induction motor are too heavy, they will afford no protection against the abuse of protracted overload. If they are too light, they will blow so often as to interfere with production, because appreciable time is required to tell which fuse or which fuses, of several, are blown in order to replace the blown ones and to again place the motor into operation. Where only fuses are used, their rating should be such that they will blow if the compensator is very carelessly handled. This means that their rating should be selected to suit the load that the motor actually handles and not the load that it could handle. Assuming that the minimum convenient rating of a fuse has been experimentally determined for existing load conditions, then if the load should increase on account of hot boxes, of tight belts or of rubbing rotor, there is more probability that an increase in the frequency of the fuse blowings would suggest an irregularity which could be sought and removed before serious damage could result. If an operator knows that a fuse will blow when he fails to give the motor a fair chance on the starting side of the compensator, he is more apt than otherwise to give it a fair chance.

In one case a three-phase, 20-hp., 220-volt induction motor had its rotor down on the stator three times in three months on account of hot bearings due to the use of an inferior quality of oil. After the third failure, it was necessary to rewind the stator because the rotor had ground through the stator teeth into the stator coils. The point of interest here is that in none of the failures had a fuse blown until the rotor was actually stalled by the friction between itself and the stator. This was indicated by the fact that in each case the inertia of the connected machine, had peeled the belt almost off at the time that the fuse acted.

An investigation disclosed that the operator had become tired of paying for protection in the form of standard fuses and had adopted the practice of refilling the old cartridges with copper wire of any size that happened to be available, provided that it was heavy enough. He stated that the original fuses were a nuisance because one or more of them would blow every three or four days. It is probable that the fuses were a little light for his conditions, for the voltage was about 15 per cent high; but if he had increased their

capacity, a few amperes instead of a few hundred amperes, the chances are that the more frequent blowings that would have characterized the increased load condition due to heated bearings, would have been a warning that something was wrong. Then, if he was unable to find out what was wrong, it would have been in order to call for some one who could.

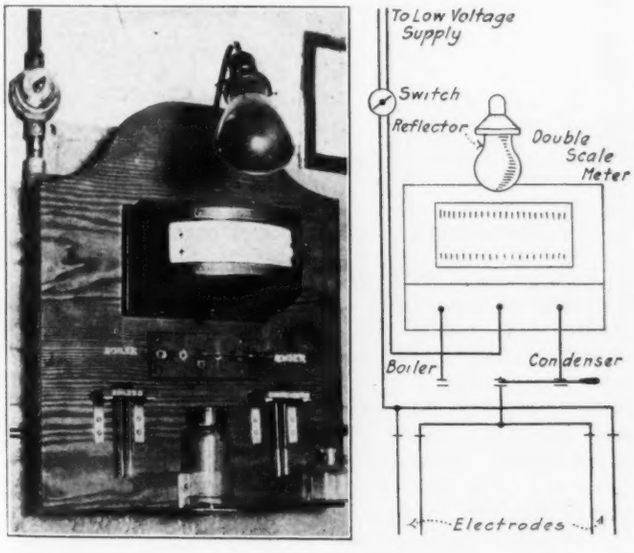
CHECKING CONDENSERS FOR SALT LEAKS AND BOILERS FOR CHANGING WATER

Electrical Method of Determining Density of Condensate and Boiler Water and Frequency of Emptying, Filling and Blowing Boilers

BY CLAUDE CHARLES BROWN

Whenever sea water is used as a cooling medium in condensers there is usually difficulty in keeping the condensers free from leaks that allow the salt water to get into the condensate. Should this impure water get into boiler feed water in any great quantities corrosion with its dangerous results may occur and dense scale may be deposited. These evils are especially liable to be emphasized if the boilers operate at overrating. As titration and chromate tests for leakage have not been found satisfactory at the Station A of the Pacific Gas & Electric Company, San Francisco, where Charles A. Eastwood is superintendent, an electrical test has been developed whereby the amount of salt in condensate, feedwater and boiler water can be found exactly and quickly.

The apparatus consists of a sample measure, test bottle and two sets of electrodes connected in series with a double-scale milliammeter by a single-pole double-throw switch. One set of electrodes is for testing boiler water and the other for condensate. The upper scale of the milliammeter used in testing the condensate has a range of 0 to 6 grains of salt per gallon while the lower scale



FIGS. 1 AND 2—APPARATUS FOR TESTING SALINITY OF BOILER WATER WITH DIAGRAM OF ELECTRICAL CONNECTIONS

used in conjunction with the boiler-water electrodes has a range of 6 grains per gallon to the density of sea water.

To test boiler water, the small measuring bottle is filled with a sample and emptied into the test bottle which is then brought up under the boiler-water electrodes until they touch the bottom. The single-pole switch is thrown to the left position marked "boiler" and the lower scale of the meter read. Condensate is tested similarly but with the "condenser" electrodes, and the switch reversed so as to read the upper scale.

Over the range of conditions tested—0 to 300 grains of salt per gallon—the meter reading is approximately proportional to the salinity of the sample provided the same immersion of the electrodes and the same voltage across the terminals of the apparatus is assured. The

PACIFIC GAS AND ELECTRIC CO.
CONDENSER SATURATION REPORT

STATION "A" DATE

GRAINS SALT PER GALLON

TIME	No 5	No 6	No 7	EXCITER	REMARKS
1 A. M.					
2					
3					
4					
5					
6					
7					
8					

FIG. 3—FORM ON WHICH RESULTS OF TEST ARE RECORDED

latter condition is assured as mentioned previously by placing a definite quantity of the sample in the test bottle. Since the scales were calibrated by means of solutions whose density had been tested chemically, the instrument will give readings within 5 per cent of accurate. Tests by this method have compared so favorably with chemical tests that all other tests have been abandoned.

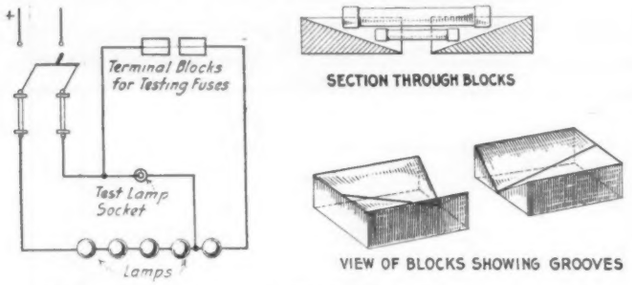
Beneficial effects have been noticed in several ways since the adoption of this method of testing. In the first place quantitative measurements instead of mere qualitative indications are obtained. As a result the boilers to empty, refill and blow down can be selected on a scientific basis instead of as before when two boilers were emptied and filled in rotation regardless of water density. Under present conditions the two boilers containing the densest water are emptied and refilled each night. The selection of boilers to blow down is made in the same manner, about two gages of water being discharged. With the old qualitative tests it was a matter of guesswork whether to "put a condenser on the sewer," when to reconnect it to the feed line, when to "plug" or repack the condenser tubes, whether leak repairs were effective, etc. The definiteness of the present tests eliminates all guesswork, however, so less scale is deposited, less tube cleaning and repairing are required, less fuel has to be burned per pound of steam generated, and less water and absorbed heat are wasted. Some idea of the amount of improvement permitted by the use of the present test and method of changing water can be gained from the fact that the average density of the boiler water has been reduced from 250 to 50 grains of salt per gallon of water.

Graphical Presentation of Conductor Properties

In using the chart which supplemented the article entitled "Graphical Presentation of Conductor Properties" (Feb. 10 issue of the ELECTRICAL WORLD, page 269), it should be noted that the length of copper wire in meters per kilogram must be obtained by using curve 22, the resistance in ohms per foot by using curve 18, and the weight in kilograms per ohm by using curves 12 and 30. The "key to chart" should be corrected accordingly.

Special Contacts for Testing Continuity of Fuses and Lamps

Contact blocks by means of which fuses of different lengths may be tested for continuity are shown in the accompanying illustrations. The blocks contain slanting V-grooves to accommodate fuses of various sizes, and also to protect the operator from electrical contact. Two blocks are so placed in the testing circuit that the smallest fuse can just span the distance between them.



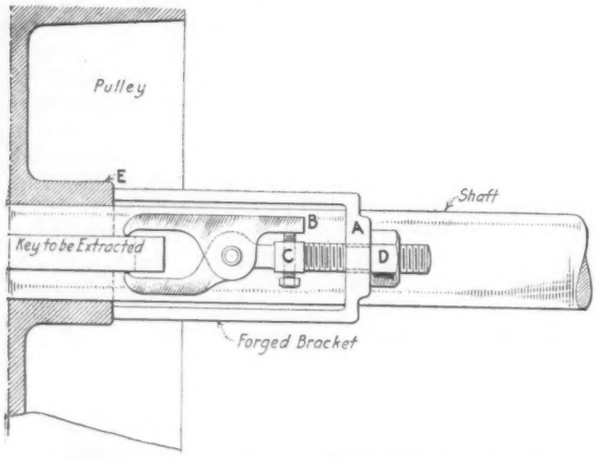
SAFE CONTACT BLOCKS FOR TESTING FUSES OF VARIOUS LENGTHS

Larger fuses make contact nearer the opposite ends of the blocks. With this arrangement the middle point of the fuse held in the operator's fingers is remote from the bottom of the groove, thus insuring greater safety. The terminal blocks and an old-style, threadless socket, into which lamps to be tested can be quickly pressed, are mounted on a slate base with the other apparatus.

Simple Arrangements for Extracting Tight Fitting Pulley Keys

BY EMILE PILPEL

The writer has found the device shown in the accompanying illustration useful when removing pulleys that are tightly fitted and unaccessible from the inner side. Such cases are found frequently on line shafts having loose and fast pulleys, on spiders of electric motors, motor-generator sets, etc. The apparatus consists of

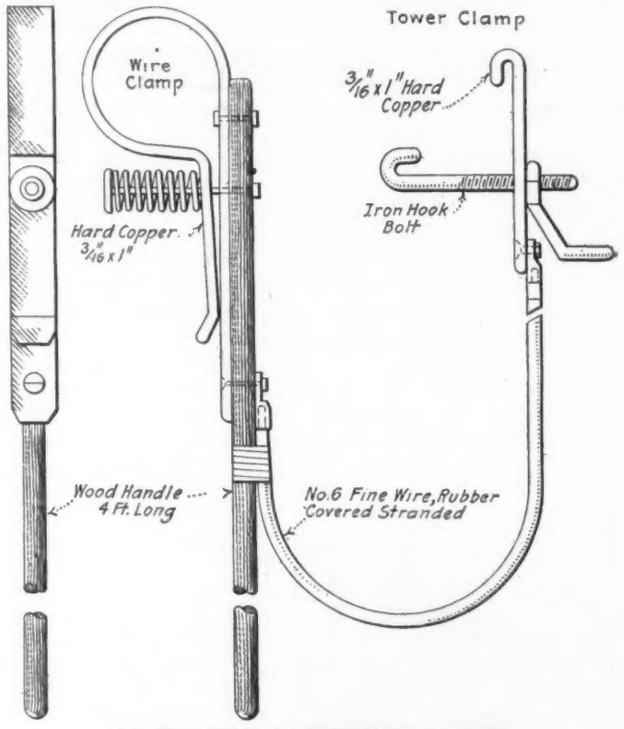


DEVICE FOR PULLING KEYS FROM MOTOR PULLEYS

one inverted U-shaped forge bracket *A* lying very closely to the shaft towards the key to be extracted and pressing against the boss of the pulley *E*. After making an incision with a cold chisel the tongues *B* are placed so as to grip tightly the key at the incision thus made. This grip is held by means of the set screw *C*. Finally by aid of a wrench the legs of bracket *A* are forced against the boss of the pulley by screwing down nut *D*, when gradually the key will give way. A 1-in. machine screw with an extra wide nut will be found satisfactory for the construction shown in the illustration, in most cases.

Scheme for Grounding Circuits to Make Repair Work Safe

Two simple devices which are illustrated herewith have been developed by F. A. Whiting of the Connecticut Power Company for grounding apparatus or conductors preparatory to working on them. The clamps are particularly adopted to conditions which would be met on steel-tower transmission lines but may be used also in stations. The smaller of the two devices is for attaching the grounding cable to grounded structural steel such as tower legs while the larger device which is connected with the other end of the grounding cable is for slipping over the circuit to be worked on. The former consists of a strip of hard copper with one


Tower Clamp
Wire Clamp
3/16" x 1" Hard Copper
Iron Hook Bolt
Hard Copper 3/16" x 1"
Wood Handle 4 Ft. Long
No. 6 Fine Wire, Rubber Covered Stranded

CONSTRUCTION OF GROUNDING CLAMPS

end bent back on itself so as to fit over an angle iron. Near the other end is a hole through which passes a threaded rod having one end bent back on itself to form a shoulder. Screwed on the rod is a tapped lever.

The conductor clamp which is provided with a seasoned hardwood handle consists of a curved strip of spring metal, one end being permanently attached to this handle and the other free to move but pressed against the former by a helical spring. The latter is coiled around a bolt passing through both ends of the spring strip.

Six pairs of these clamps connected by cables are kept in each line patrolman's booth on the Connecticut Power Company's system to permit grounding the three conductors of a three-phase circuit on each side of the section to be worked on. The tower clamps are attached to the tower legs first. Then, after the line has been "killed," the conductor clamps are slipped over the conductors. The wooden handle of this device attached as shown in the illustration gives ample protection from static and inductive charges.

Flood-Lighting a Dark Corner in a Substation

A dark section in the Greensboro (N. C.) substation of the Southern Power Company is lighted by means of an old automobile headlight in which is placed a 60-watt tungsten lamp. This section, which is at one end of the station, was built without ceiling or wall lights. At this point a number of oil switches are installed and the numerous leads from them make it difficult to place lights in advantageous positions. To enable the operator to go among the switches when necessary at night the automobile lamp was mounted by means of its bracket on a switchboard near the dark section. This gives good illumination directly in front of the lamp, which may be revolved to light any portion of the dark section. H. L. Alderman, division superintendent of the company, who originated the idea intends to install several more of these lights so as to keep the entire section properly illuminated at all times.

Collapsible Cable Splicers' Platform Designed for Easy Handling

A platform which has been found convenient for cable splicers working on overhead construction has been recently developed by the Commonwealth Edison Company of Chicago. The construction is shown in the accompanying illustration. It consists of a compact platform 42 in. square made of 0.75-in. boards nailed to two 1-in. by 4-in. end pieces. At each corner of the floor is bolted a 1-in. by 4-in. pipe flange. One-inch holes are bored in the floor to coincide with the center holes in each pipe flange. From these flanges four pieces of 0.75-in. pipe rise vertically to form the supports for a rope railing which runs around the platform at a height of 30 in. above the floor. The rope at the

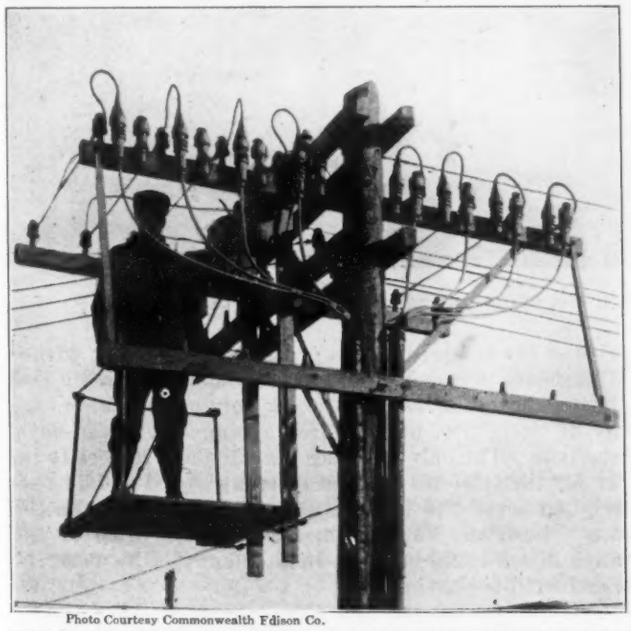


Photo Courtesy Commonwealth Edison Co.

FIG. 1—PLATFORM MOUNTED ON CABLE POLE SHOWING RELATIVE POSITIONS OF UPRIGHT AND FLOOR

top of these pipes is passed through tees, from which the threads have been cut to make them smooth. These upright pieces of pipe are so arranged that when they are lifted they become partially disengaged from the pipe flanges and can be laid over flat against the floor. They cannot, however, be detached entirely from the platform. Under the platform are bolted four eye bars, which are used to fasten the floor to the supports. This type of construction permits a platform and railing, which occupies a space 42 in. by 42 in. by 30 in. when it is set up, and can be packed quickly and conveniently in a space 42 in. by 42 in. by 3 in. The platform completely equipped weighs less than 100 lb.

The method of swinging this platform from a pole is

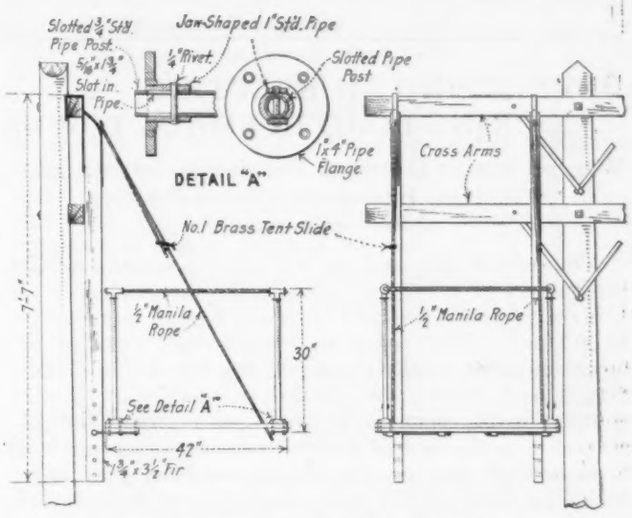


FIG. 2—CONSTRUCTION OF A CABLE SPLICER'S PLATFORM

interesting. Two vertical supporting pieces which consist of forged 0.5-in. iron hangers bolted to 1.75-in. by 3.5-in. pieces of dressed fir 7 ft. 2 in. long, are first drawn up the pole and suspended from the top crossarm. These two pieces are bored to receive a ⅝-in. bolt at several places near their lower ends. They weigh about 20 lb. and can be easily drawn up by a hand line. The line can then be attached to the edge of the platform, and when it is raised to the level of the ⅝-in. holes the protruding eye bars on the edge of the platform can be bolted to the fir pieces. The platform can then be swung out into a horizontal plane and suspended there by means of 0.5-in. ropes which fasten to hooks on the forged hangers. These ropes may be adjusted by means of brass tent slides to make the platform stand in a horizontal plane. With this rope adjustment and the variation in height which is made available by the several holes in the fir pieces, it is possible to place the platform in almost any position that the workmen desire.

An Inexpensive and Accurate System Map

The Utica (N. Y.) Gas & Electric Company, which, in addition to its steam plants operates several interconnected hydroelectric stations that draw from different drainage basins, is using a map of its system made in a novel manner. It consists of United States Geological Survey maps fitted together to show on a large scale the territory covered by the company. Since these maps originally had contours and other physical characteristics of the country plotted accurately on them, it required very little labor to map out and measure the drainage area tributary to each plant, to lay out transmission-line routes and to place any other useful markings in their proper locations.

Aside from being very accurate, a map made in this fashion has the additional advantage of being inexpensive. The sections can be obtained from the United States Geological Survey at Washington, D. C., for 5 cents each for those sections of the country in which the Geological Survey has completed its work.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

DEVELOPING AN ELECTRIC-COOKING LOAD IN SMALL TOWNS

Why an Illinois Company Decided to Sell Ranges—And How Interest in Electric Cooking Was Stimulated

The reasons for making the electric-range business the subject of a special drive in the territories of the Illinois Northern Utilities Company may be summarized as follows: First, electric cooking was seen as one means of substantially increasing the revenue in already served and fairly well saturated territory. In the smaller of the company's many towns where no gas service is available and where electric cooking has been most actively pushed, the electric revenue per capita, excluding merchandise sales, ranged from $3.50 to $10.

THE ARRIVAL OF A CAR-LOAD SHIPMENT OF RANGES WAS MADE THE OCCASION FOR AN ADVERTISING DEMONSTRATION

An opportunity was seen materially to increase this figure since some experience has demonstrated that the average cooking customer consumes about seven times as much energy and returns about twice as much revenue as the average lighting customer. To this, of course, was to be added the merchandising profit.

Second, it was thought that the system load factor of the small interconnected towns would be bettered by electric cooking. From what was known of load conditions in the communities the companies' engineers concluded that the range load would be entirely off peak in the summer and largely off peak in the winter, since the maximum demand of these towns occurred in the early evening.

Third, other advantages were recognized in that circuits carrying electric ranges must have good service. On lines used for electric cooking, voltage regulation and service continuity must be maintained better than for ordinary lighting to avoid complaints. It was, therefore, figured that the installation of ranges in these scattered communities afforded a definite check on the activities of the many local operating departments. It is probable that before long extensive repairs on circuits carrying ranges will have to be made early Sunday morning, since that is about the only time the circuits are not in use.

In this territory the electric range had all kinds of competition to meet. The cities ranged in size from 100 to 20,000 population. The larger towns, of course, had gas. In all the communities other fuel prices were reasonable. Coal was $3 a ton, gasoline was 22 cents a gallon, kerosene was 10 cents a gallon, and wood was not used much for fuel. The electric cooking rate on which the campaign was started brought electricity to the consumer at about 3.25 cents net per kilowatt-hour.

Following the line of least resistance the towns where gas is not available have been attacked first. The first effort in each case has been to sell the ranges outright; for the range installed the customer is asked the list price of the range; but if a prospective customer wishes to purchase a range, but expresses doubt as to its real ability to cook, or as to its using only a moderate quantity of electricity, he is offered a range on fifteen days' free trial. The only expenses the customer agrees to incur for the trial are the cost of energy used and $4 partially to cover the installation cost. If he accepts the range, however, he pays merely the list price of the range in ten equal monthly installments. Five per cent is deducted for cash.

Getting the ranges and the companies' offer before the people favorably has been a job that has called forth the ingenuity of the sales manager. Of his efforts in the campaign of last year, C. B. Yonts of Dixon said:

"In starting a campaign in a town we place an ad in the local newspaper. It states when and where we will hold demonstrations. For these affairs we have generally rented a ground-floor room in the business district. Later we distribute hand bills and at the same time have salesmen make a house-to-house canvass and invite the housewives to attend our demonstration. At every demonstration we succeeded in getting a number

of the ladies to bring their bakings; our demonstrator baked whatever they brought. The salesman was there to take orders for ranges.

"One of the stunts which proves successful in making the sale of a range is that of putting out an ovenette with each electric range. In many instances a customer would want to do just a little baking, such as a few potatoes, a pan of biscuits, a pie or cake, or even a small roast; the ovenette saved heating the range over for this purpose. The cost of the energy consumed with this ovenette was small compared with that used by the large oven for a little baking.

"When we learned we could buy in carload lots, we worked another advertising stunt that proved well worth while. We would order a carload of ranges shipped to the city in which the district office was located. The car would be placarded 'Electric Ranges for Ogle County, Illinois Northern Utilities Company.' The ranges for this town would be loaded on trucks and hauled about town. Boys with trumpets on the trucks made enough noise to attract the attention of everyone to what was going on. Placards on the trucks and hand bills told the story. The freight car would then be forwarded to the next town and the performance would be repeated. This was one of the cheapest and best advertising methods we used.

"In one particular town we did some pioneering three years ago that has netted results. When the cooking rate was 5 cents we sold one range in that town. In the following year when the rate dropped to 4 cents we sold fourteen ranges by referring to that particular installation. This year when the rate dropped to an average of 3.25 cents, we sold eleven ranges during the first canvass and doubled that figure before the end of the summer season.

"But the real success of the electric cooking business depends on properly educating range customers. Evidence of our success in this regard is to be seen in the customers' bills. It is no uncommon thing for customers who have had the services of a demonstrator on the first and second day the range is installed to have bills as low as 80 kw.-hr. a month. Without this educational service at first their bills would run above 100 kw.-hr. The demonstrator, besides giving verbal instructions, leaves printed rules with the housewife. This prevents the customer from forgetting what she has been told and shown. Since the rate was reduced to 3.25 cents the Illinois Northern Utilities Company has sold 200 ranges."

POINTS ON CUSTOMER'S CONTRACTS

Information for the Manager of the Central Station that Sells Motors to Power Customers

The function of a contract is to reduce the terms of an agreement to writing and to prevent future misunderstanding between the parties of that agreement. In an address before the district managers of the Texas Power & Light Company at Dallas, Tex., Hartwell Jalonick, commercial manager of that company, pointed out the importance of having signatures and equipment details of central station contracts absolutely explicit and accurate.

The central station rarely finds it necessary to enforce a contract with a customer, said Mr. Jalonick. Especially is this the case in connection with service contracts. Owing, however, to the fact that many central stations are now handling considerable quantities of machinery which are sold to customers, it is important that the apparatus contracts covering the sale of this equipment should be correct to such an extent that there will be no chance of the company suffering loss on the account of an unfaithful customer.

A very important point and one which is often overlooked, is that the signature to a contract must agree with the name first written in the contract. If a contract is taken with "Smith & Company" and signed simply "J. F. Smith," the point would at once arise, in case the matter should be brought into court, whether the contract was with an individual or with a corporation. Such a contract should be signed

Smith & Company
By J. F. Smith, Pres.

or in a similar manner by some other known executive.

Another important point is to make clear whether the party with whom the contract is being taken is a corporation or an individual. If the company is a corporation, a good form to use is,

Farmers Cotton Oil Company
A Texas Corporation.

Or if it is a partnership,

John Smith and John Jones, a co-partnership doing business under the firm name or Jones & Smith.

If it is an individual operating under a business name, then describe him as

John Jones, doing business as Farmers Cotton Oil Company

In obtaining a signature such as is shown above (Smith & Company) the firm name should always appear first in order that no question may arise as to whether the contract is with the company. If it is signed

J. F. Smith, President, Smith & Company

it might be construed as a contract with the individual, J. F. Smith, the firm name having been added in order to identify Mr. Smith.

In cases of partnerships it is well to have the contract signed by both parties as

Smith & Jones
John Smith
John Jones

If there is a manager and you know that the manager is authorized, then the contract could be signed

Smith & Jones
By John Jones, Manager.

The former practice, however, is the better.

Another important point in connection with equipment contracts is the location of the customer to whom the equipment has been sold. This location is important since the company cannot exercise the privilege of lien as specified in the contract unless the location is known and the place of residence of the party or company who signs the contract is clearly stated on the face of the contract.

Furthermore, when equipment is sold on time, there should be something in the contract which will absolutely tie the equipment or identify it as belonging to the company. It is not necessary in such cases to have a tag placed on all equipment stating that the apparatus is the property of the company, but the equipment should be described very fully as:

One 75-hp., 2200-volt, 1200-r.p.m., three-phase, 60-cycle, motor, complete with compensator, base and paper pulley 13 in. in diameter by 13 in. face.

and not simply as

One 75-hp., 2200-volt motor.

It is well when possible also to give the manufacturer's serial number of the motor.

In connection with installment payments, one cannot

be too definite in stating the exact time at which each installment is to be paid as:

$500 on March 1, 1917
$185 on March 1, 1918
$185 on April 1, 1918
$185 on May 1, 1918.

This is much better than saying "$500 Cash when equipment is installed, balance in three payments of $185 each, payable on the first day of each month, beginning March 1, 1918."

Provision as to the amount and payment or non-payment of interest should also be clearly set forth.

The importance of filing equipment contracts depends on the amount involved and the nature of the specific case. The advantage of filing is that by so doing the company avoids the possibility of some subsequent lien.

The final clause, "This contract supersedes all representations, promises or other inducements, written or verbal, made with respect to matters herein contained," is considered valid, and can be upheld, hence it is important that every agreement made, if of any importance, should be included in the contract. Any changes or interlineations made in the standard form of contract should be initialed or the contract re-drawn.

Rural Service Found Unprofitable by Indiana Company

BY ALEX. R. HOLLIDAY

The case affecting the monthly minimum charge of the Noblesville Heat, Light & Power Company of Noblesville, Ind., which was decided recently by the Indiana Public Service Commission, brought out the experience of this company with rural service. Authority was asked from the commission to make a new classification of rural and village customers, with separate minimum charges for each class. The commission decided to allow a minimum monthly charge of $1 for rural customers instead of the charge of 50 cents which had been made by the company previously. If the operation of the new rate during the ensuing year is unsatisfactory the company will appear before the commission again and ask for additional relief.

The company filed its petition with the commission in March, 1916. The rates charged under its existing schedule were 10 cents per kilowatt-hour for the first 25 kw.-hr., 8 cents for the second 25 kw.-hr., and 6 cents per kilowatt-hour thereafter. The minimum charge was 50 cents per month. Practically all of the rural customers had contributed from $25 to $62.50 on line construction to the company, which was refunded in energy. They had also paid for their service connections and transformers, but for these they were not reimbursed.

In its petition to the commission the company stated that the business was unprofitable, and that if it was to be extended it should be placed on a profitable footing. The actual expenses per customer are over $25 per consumer. It was considered best to increase the minimum charge instead of raising the rate for energy as the chief expense in serving the customers is overhead charges and distribution.

The company wished to define rural and village customers as "all customers living without the corporate limits of a city or town and to whose premises the company owns or shall own an electrical distribution system." A rural customer was defined as a customer who together with not more than three other customers is served by one step-down transformer, and a village customer as one who together with at least four others is served by one transformer. A minimum of $2 per month was asked for rural customers and $1 for village customers. No change was asked in rates for energy. The theory of the two classifications was that the small group of customers were served more cheaply than the isolated farmhouses.

Among the village customers was a county grain elevator on a 3-cent power rate. Eliminating this elevator, the strictly country business was analyzed as shown in the accompanying table for the year ending June 30, 1915:

Kind of Customers	Number of Customers	Number of Motors	Horsepower of Motors	Transformer Capacity	Average Kw.-Hr.	Average Revenue	Average per Kw.-Hr., Cents
Rural	145	25	34.5	163	192	$16.79	8.8
Village	74	2	4.5	36	129	13.90	10.8
Total	219	27	39	199	172	$15.85	9.2

The minimum rate increase which was asked by the company would have increased the gross revenue from $3,716 per annum to $5,086, or $1,370, equal to 37 per cent.

In a paper which was presented by the writer before the Indiana Electric Light Association on Sept. 23, 1914, discussing the results of experiences with rural customers, the statement was made "that until the customer averages nearly $3 per month he is not a paying experiment under these conditions." We still believe that this statement is true. The mistake which we have made is in believing that the rural customers could be developed to the point where they would consume energy of that value. The figures published herewith show that these customers have not reached this level. As but 4 per cent of our gross revenue is derived from this class of business, the question of whether or not the rural customer is profitable is not a controlling one. However, we have devoted more time to an interesting experiment than the revenue warrants. For the present we shall not encourage the construction of rural lines.

Strengthening Relations with the Power Consumer

A central station company operating on the Pacific Coast makes a point of "getting acquainted" with every new power consumer. So far as practicable, the industrial engineer goes over plans for every new installation and serves the customer in a small way as a consulting engineer, suggesting changes and improvements in arrangement where these seem to be called for. Even if there are no recommendations to be made, the customer still receives a call. For example: after a power salesman has closed a contract for new business and the motor is installed, he suggests to the new consumer that he would like to have the "boss" drop in to see how the new equipment is working. Accordingly, when the new apparatus is operating satisfactorily, the industrial engineer in company with the salesman calls on the new consumer and shows his interest by going over the apparatus. Ordinarily he inquires as to its operation, etc., and before leaving suggests that in putting it in service and getting it to run satisfactorily doubtless the company's engineers used up more or less current which would normally be charged on the first month's bill. The industrial engineer suggests that it would be fair to remit this to the consumer. He makes a memorandum to this effect in the customer's presence and reduces the first month's bill accordingly. This has been found invariably to make a favorable impression upon the new customer and he is again reminded of the interest shown when he receives his first monthly bill with the deduction and the explanatory note.

ADVANCE IN TECHNICAL THEORY AND PRACTICE

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INDUSTRIAL CONTROLLERS

A Discussion of Controller Design, with Particular Reference to the Control of Direct-Current Shunt Motors

AT the recent New York meeting of the American Institute of Electrical Engineers an interesting paper by H. D. James was presented on industrial controllers for direct-current shunt motors. Stating that present-day development of motors and controllers is such that former limitations as to regulation of starting current from the viewpoint of motor, controller and supply system have been largely removed, the author presented a series of tests on 15- and 20-hp., 230-volt, direct-connected shunt motors, started from rest. The motors were of two types, constant and adjustable speed. These tests were made to determine, first, the load driven by the motor; second, the power supply; third, the motor operation.

For details of the tests the results of which are given in form of a series of diagrams, the reader must be referred to the full paper in the February issue of the *Proceedings* of the American Institute of Electrical Engineers. The author's chief results are as follows: It seems unnecessary, with automatic acceleration, to use more than one switch to short-circuit the armature resistor used with small motors except where special requirements are to be met. The author believes it is practicable to use one switch with motors as large as 15 hp. for general purposes, and operates this switch by counter emf., setting the switch to close at 75 per cent of normal voltage.

If the motor field is zero, or has a small value, when the line switch is closed, the starting torque is also zero or has only a small value and it will increase gradually so that the motor, or its load, will not be subjected to a heavy shock or jar when the lost motion in the drive is taken up.

The shunt field of small adjustable-speed motors can be reduced in one step under normal load conditions without fear of undue torque or current. The author believes this practice can be safely followed with 50-hp. motors and perhaps larger. This covers the usual range of sizes for this type of motor.

The author believes that since most machine tool motors are started light the motor can be started successfully with minimum field strength and the field relay omitted. This will enable one to use the same controller for constant speed and adjustable speed motors supplying a separately mounted field rheostat for the latter.

Adjustable-speed motors can use one step of resistance for dynamic braking as the change in field strength tends to maintain the braking current constant over a considerable range of speed. The use of a "vibrating" or "fluttering" relay is bad engineering for hand-operated field rheostats, unless a "transfer" relay is also used to reverse its action when the motor regenerates. The time required to accelerate to 95 per cent of speed is very short, in these tests not exceeding three seconds.

New problems are interestingly discussed by the author as follows: There are very few problems which present a more fertile field than the control of adjustable-speed motors. The writer has observed cases where gearing has broken, due to a momentary reverse torque of the motor. It is important to see that all interlocks or relays connected to the shunt field resistance are so arranged that they cannot cause a momentary reverse torque of the motor. After a positive torque has been applied to machinery, and all of lost motion taken up, it is seldom that any part of the apparatus is injured, even if the driving torque varies over a considerable range, provided this torque is always positive. A slight negative torque allows lost motion to occur, and is apt to break some part of the apparatus, due to the hammering blow effect, when the positive torque is resumed. This reverse torque may also be caused by a drop in the line voltage below the counter e.m.f. of the motor, or it may occur due to a rapid movement of the field rheostat.

Trouble may also result from increasing the field strength of a motor when it is disconnected from the line. For example, a 400 to 1600 r.p.m. motor is operating at its maximum speed. If the controller disconnects the motor armature from the line, and at the same time increases the field strength to its maximum value, the voltage across the brushes of the motor will rise to something over three times normal voltage, unless the armature is slowed down very quickly. It can readily be seen that a 500-volt motor, having over 1700 volts across its brushes, is apt to flash across at some part of its insulation and may ultimately be damaged. This rise of voltage has actually been observed, and care must be taken not to manipulate the shunt field so as to cause it.

The use of dynamic braking introduces a good many interesting problems, both mechanical and electrical. The additional heating effect on the motor is well known. The effect, however, upon the loading and lubrication of bearings is not so well understood. The resultant change in the field flux of the motor and the rate of change of current are other problems.

The whole field of controller engineering presents many opportunities for the investigator. It has many problems that have not yet been solved, and the author believes that engineers should not take the existing practice in controller engineering for granted, but study each application in a thorough manner, and design as simple a controller as possible for the work.

Generators, Motors and Transformers

Adjustable Speed Induction Motors.—F. CREEDY.—An illustrated description of a new polyphase induction motor, the speed of which can be varied by varying the number of poles. The new motor, which is built under the author's patents, is identical in construction with the squirrel-cage induction motor, but has a drum-wound stator or primary; this is divided into a number of sections which can be connected in either "mesh" or "star." From each section a terminal is brought out, which connects through a suitable controller to a phase converter, consisting of a specially wound transformer, whose function is to convert from the two- or three-phase line to a number of phases equal to that of the sections in

the motor winding. By the use of this phase converter and a suitable controller it is possible to vary the phase difference between adjacent sections of the stator winding in such a way as to produce any desired polarity. In Fig. 1 is shown such a winding, having thirteen terminals connected to a phase converter, giving thirteen phases, in such a manner as to give two, four or six

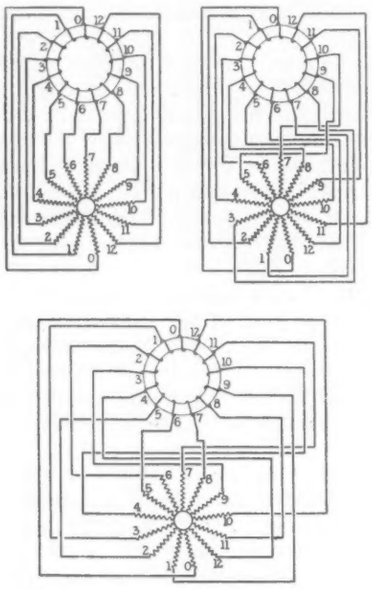


FIG. 1—ADJUSTABLE-SPEED INDUCTION MOTOR CONNECTIONS

poles. If every terminal of the motor is connected in order to the corresponding terminals of the phase converter the phase difference between the adjacent sections of the motor will be the same as that of adjacent sections of the phase converter (that is, 360 divided by 13 in the case shown) when the motor will operate as a bipolar machine. If the motor terminals, starting from a given point, are connected to every second converter terminal, the phase difference between the sections will be doubled, and the motor will operate with four poles. Similarly, if the motor terminals are connected to every third phase converted terminal, the phase difference between adjacent sections will be tripled, and the motor will operate with six poles, and so on. In all cases, if the number of sections is properly chosen, one converter terminal goes to one, and one only, of the motor terminals, so that all terminals of both apparatus are in use on every polarity. The advantages of this type of motor are discussed. Comparing a six-speed machine of this type with a standard drum-wound three-phase

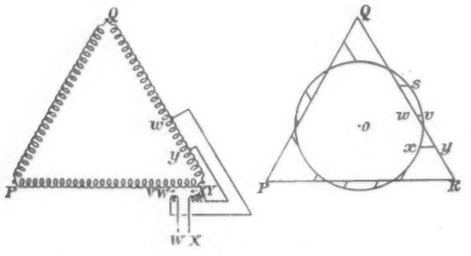


FIG. 2—TYPICAL CONNECTIONS OF COILS ON PHASE CONVERTER

machine with ten poles, the latter will have thirty sections in its stator winding as against thirty-one in the former, these sections being interconnected so that only three or six terminals need be brought out; while in the variable-speed motor no such interconnections exist, but each section is brought out to a separate terminal. The phase converter consists of a mesh-connected three-limbed three-phase autotransformer, the coils lying on each limb being tapped at a number of points and connected to a secondary wound on another limb, in the manner shown diagrammatically in Fig. 2, where, for instance, *w y* is a section of the main three-phase winding of the converter, while *w v* or *x y* are secondaries, the manner in which they are connected being more clearly shown on the left. Fig. 2, of course, shows a three to thirteen-phase transformation, but in the case of the three to thirty-one-phase transformation two of the coils on the three-limbed transformer are divided into ten sections each, while the third has eleven sections. Each of these sections is wound and insulated separately, so that in the event of a fault occurring only one section will need repair. Each section consists of a primary or thick wire portion, part of the mesh connected three-phase winding and a secondary of thin wire, and very few turns, which will be one of the coils marked *x y* in the figure. Thus far the phase converter is identical with a standard three-phase transformer. The terminals are arranged in a row mounted on the steel head of the transformer which is also used for clamping and lifting. They are connected to all such points as *w* and *x*. In order to give some idea of the size of the apparatus, it may be mentioned that it is about equal to that of a normal transformer to deal with 25 to 30 per cent of the motor input. It is supported in a cast-iron oil tank, from which the wiring is carried by means of tubing. The construction of the controller is next described and diagrams giving results of tests of the motor are given.—*London Electrician*, Feb. 2, 1917.

Lamps and Lighting

Precision of Photometric Measurements.—F. K. RICHTMYER and E. C. CRITTENDEN.—A brief abstract of a paper read at the Cleveland meeting of the American Physical Society. Progress in any department of physical science, as was pointed out by Professor Zeleny, is dependent in large measure upon our ability to make more and more precise measurements. It is of interest, therefore, to inquire into the present available precision in the various lines of experimental work in order to determine what factors make greater precision possible. The present paper is the result of an analysis of 20,000 observations showing the precision attainable in a number of different kinds of photometric measurements; with a Lummer-Brodhun photometer for both a color match and a color difference; also with a flicker photometer for a large range of color differences. The precision attainable with the Lummer-Brodhun was approximately 0.3 per cent for color match; increasing color difference caused a marked decrease in sensibility. With the flicker photometer the precision 0.75 per cent approximately independent of color difference was obtained. By precision is here meant average deviation of a single observation from the mean of its set.—*Phys. Rev.*, January, 1917.

Generation, Transmission and Distribution

Protection of Transformer Neutrals Against Destructive Transient Disturbances.—MAX H. COLLBOHM.—A paper read at the recent New York meeting of the American Institute of Electrical Engineers. The author points out the danger to which the neutral points of transformers, connected to long-distance transmission lines, are exposed through the building up of excessive potentials at this point under conditions of atmospheric lightning. This is due to the fact that the neutral point in a bank of Y-connected transformers acts as a reflection point for all the waves that are produced by induced lightning, which waves, at the place of origin, have the same amplitude and sign, and therefore, travel with equal speed, considering that the impedance of line and

transformer is the same for each phase. The three waves meeting at the neutral point build up to three times their individual potential at that place, thereby producing excessive potential stresses, and, according to experience, destruction of bushings and windings. The author recommends the installation of lightning arresters at the neutral point to provide a discharge path for the excess potential, which according to measurement with a spark gap, may reach values of 350,000 volts, and higher.—*Proceedings* Amer. Inst. Elec. Engrs., February, 1917.

Traction

French Railway Electrification.—C. THOMAS.—The first part of an illustrated article on the electrification of certain sections of the French State Railways, the change had been projected in 1913, but had naturally been retarded by the war. The present instalment describes the transformer substation of Pont-Cardinet which receives 25-cycle three-phase currents at 15,000 volts from the power plant at Bezons and three-phase current at 5000 volts from the power plant at Molineaux and transforms them to 650-volt direct current for traction and also supplies a 2 x 250-volt three-wire direct-current system for lighting and power.—*Revue Gen. de l'Elec.*, Jan. 6, 1917.

Installations, Systems and Appliances

Centralization of Power Generation and Supply in Germany.—At the general meeting of the Association of German Electrical Engineers last summer Professor Klingenberg had discussed the tendency towards centralization of the German electrical industries. Together with Siegel he had recommended that the German government should undertake the generation of electrical power, but not the distribution. Klingenberg had recommended the erection of thirty large government-owned and government-operated power plants in Prussia which should all be interconnected by 100,000-volt lines. The state thus should generate the electric power on a large scale, but the retail sale should be left to the present owners of the electric stations (which would be substations in future). These recommendations were discussed at some length at the meeting of the German Association on Central Stations in Berlin on Dec. 4 and 5, 1916. Most of the speakers were against Klingenberg's proposals. The main report was made by Ernst Voigt, who emphasized that no real public interest would be served by the government taking over electric power generation. Not more than a very small reduction in cost of power generated could be accomplished in this way. Neither would there be a notable saving in coal since the public central stations of Germany consume only 2 per cent of the total coal mined. Small consumers would have to hope for very little in the way of a reduction in the cost of the kilowatt-hour since only a small part of the cost is due to the cost of generating the power, while the balance (about 8.75 cents, with an average price of 10 cents per kilowatt-hour) is due to the cost of distribution and the profit of the central station. Of all the central stations in Germany about 500 are furnishing yearly in the average each 50,000,000 kw.-hr. while 2500 stations furnish in the average each 100,000 kw.-hr. The present electrical industry is already engaged in inducing these 2500 plants to make connections with the large 500 stations. The government could hardly do much more. The idea of letting the state take over the generation of all the power would meet unsurmountable financial difficulties. The speaker was in favor of combining the present central stations in a compact district into one unit, but not to the extent of combining all the stations in the country into very large units with 200,000-volt transmission lines. Zell then discussed what had been done in Bavaria by the government in the development of water powers for electricity supply. Monath discussed the conditions in Wurttemberg. In his reply Klingenberg emphasized that by the interconnection of all the stations in Germany the load factor would be improved from 0.2 or 0.3 to 0.3 or 0.4. (This idea is further developed in a separate article by Klingenberg in the same issue.) Furthermore, only in large stations it pays to recover the by-products from the fuel. He emphasized that 100,000-volt transmission lines are perfectly safe and reliable. The interconnection of various large stations represents a large reserve capacity for any one of them. Spengel did not think that by centralizing the whole electric power generation in one system owned by the state it would be possible to reduce the cost. He considered the scheme to be financially impossible. Plassmann thought it was a great tactical mistake to let the state generate the energy and deliver it to the cities and let the cities sell the energy to the consumers, because the consumer would then look at the cities as an expensive and troublesome middleman. He recommended that the cities should combine among themselves and erect large power stations and furnish energy directly to the consumers. Voigt, in speaking again, emphasized that he was not absolutely against centralization of electricity supply, but he recommended that the existing central stations should proceed themselves in this direction in a logical and natural way.—*Elek. Zeit.*, Dec. 28, 1916.

Units, Measurements and Instruments

Determination of the Degree of Uniformity of Bars for Magnetic Standards.—RAYMOND L. SANFORD.—Magnetic standard bars are used for the calibration of permeameters and the comparison of methods of magnetic testing with a standard method. One requisite of magnetic standard bar is that it shall be magnetically uniform along its length. If this condition is not met, errors may arise which cannot be calculated or eliminated from the measurements and which may be of considerable magnitude. This paper describes a method for determining the degree of magnetic uniformity of straight bars, indicates the magnitude of the effect of non-uniformities on the accuracy of magnetic measurements and gives a criterion for the degree of uniformity of bars for magnetic standards.—*Scient. Paper, Bureau of Standards*, No. 295, Nov. 21, 1916.

Books Received

ALTERNATING CURRENTS. By Carl Edward Magnusson. New York: McGraw-Hill Book Company, Inc. 526 pages. 475 illustrations. Price, $4.

CONTRACTS, SPECIFICATIONS AND ENGINEERING RELATIONS. By Daniel W. Mead. New York: McGraw-Hill Book Company, Inc. 536 pages. Thirty-seven illustrations. Price, $3.

HYDROELECTRIC POWER. By Lamar Lyndon. New York: McGraw-Hill Book Company, Inc. Vol. I. Hydraulic Development and Equipment. 500 pages. 235 illustrations. Price, $5. Vol. II. Electrical Equipment and Transmission. 360 pages. 194 illustrations. Price, $3.50.

TELEGRAPHY. A Detailed Exposition of the Telegraph System of the British Post Office. By T. E. Herbert. New York: The Macmillan Company. 986 pages. 630 illustrations. Price, $3.50.

THE PRINCIPLES OF ELECTRICAL ENGINEERING AND THEIR APPLICATION. Vol. 1. Principles. New York: Longmans, Green & Company. 356 pages. 176 illustrations. Prices, $4.25.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

STATE-WIDE RANGE CAMPAIGN LAUNCHED IN INDIANA

Plans Have Been Formulated and Member Companies Being Taxed on Pro Rata Basis to Make Up $2,000 Fund

Acting upon a suggestion presented in a convention paper last September by R. A. MacGregor of Indianapolis, the new-business committee of the Indiana Electric Light Association has begun definite work on a state-wide range campaign. The movement has been discussed in several formal and informal committee meetings and partial plans have been formulated. The duration of the campaign will be from March 1 to June 1, 1917. O. M. Booher of Kokomo is sending letters to the central stations in the State, which lay out the preliminary plans and show how the campaign will be financed.

Portfolios, campaign headquarters with a capable manager in charge, state-wide cooking contests, state-wide advertising schemes, etc., are a few of the general details, all of which will be at the complete command of member companies. Each member company is being taxed on an equitable apportionment to make up the minimum required fund of $2,000.

ROCK ISLAND PROPOSED AS SITE FOR NITRATE PLANT

Location, Power Available and Railroad Facilities Are Some of the Advantages Cited for This Location of Proposed Government Nitrate Plant

Extensive efforts have been made to locate a government nitrate plant at Rock Island (Ill.) Arsenal. Members of a committee to further the interests of the tri-cities (Rock Island, Davenport and Moline) accompanied by H. S. Putnam, consulting engineer, New York, went to Washington where their claims were presented. Some of the advantages cited for this location follow. The Rock Island Arsenal reservation, which is far removed from the boundaries of the country, has an area of 990 acres and is the largest and best located arsenal in the United States. Railroad facilities are unequalled, and the Mississippi River and the Hennepin and Illinois canals furnish water transportation to the great lakes and all portions of the Mississippi River Valley. The development of the water power at Rock Island will solve the problem of navigation on the Mississippi River, now handicapped by the limitations imposed by the Rock Island Rapids. More than 150,000 hp. is available at this site. Rock Island is situated on the edge of the Illinois coal fields, and an abundant supply of coal is found within a radius of 60 to 100 miles. The Illinois coal contains from 1.3 per cent to 1.5 per cent nitrogen content. The near-by coal fields furnish an unexcelled location for the construction of an auxiliary steam power plant to insure the absolute continuity, throughout twenty-four hours of every day, of the 150,000-hp. water-power development on the Mississippi. The combination of the water-power plant, with its steam auxiliary plant, is the most economical method of producing power. The power is produced at a total estimated cost, including capital costs, of less than 0.125 cent per kilowatt-hour. A 200,000-hp. combined water-power and steam auxiliary plant and a by-product plant can be constructed at an estimated cost of $19,480,000. All materials for the manufacture of nitrates are found in the immediate vicinity. Rock Island is situated in the center of the great agricultural and food producing region of the United States.

COLORADO COMMISSION SEEKS BROADER POWERS

Asks Right to Grant Certificates of Convenience and Necessity and to Control Bond and Stock Issues

In its second and third annual reports just issued by the Public Utilities Commission of the State of Colorado the idea is expressed that during the past two years the work of the commission has been largely that of laying a foundation for future development. While great strides have been made in establishing cordial relations between the utility corporation and the public, and the commission has had the supervision of all matters pertaining to service, ample power is not provided for protecting the corporation. The commission therefore asks for wider authority.

It recommends to the Governor "that the present public utilities act be amended so as to give the commission full power and authority to issue certificates of public convenience and necessity, or to deny such certificates, to any and all corporations, firms or individuals doing business or seeking to do business as public utilities. Should such authority be given to the commission it would guarantee the public utility corporation immunity from local and State politics and would guarantee the public utility corporation the right to do business for so long as it complies with the requirements of the Public Utilities Commission in regard to reasonable rates and adequate and efficient service or product.

"Thus the people would receive the greatest possible benefit from efficient management of the corporation, and the corporation in turn would be safeguarded against the possibility of unfair competition, for which, in the end, the public must pay, even though it benefits temporarily by reduced rates. Under such a provision a sufficient showing would have to be made to the commission to satisfy the commission that there was actual necessity or that it would serve public convenience for a competing company to enter a field or district already served by a public utility corporation.

"Should such an amendment be passed it should include a provision whereby any municipality would be entitled to purchase a property already constructed at a valuation to be fixed by the commission, and it should also contain a provision whereby a municipality might, upon vote of the people, erect or construct a competing plant, upon securing therefor a certificate of necessity and convenience from the Public Utilities Commission.

"The commission wishes to suggest another amendment which would place under this commission full con-

trol of stock and bond issues of the several public utility corporations already existing within the State of Colorado, and all public utility corporations which hereafter may be organized for the purpose of serving the public. Such a provision exists in the laws of many of the states and has been found beneficial, both to the public and to the corporations, inasmuch as it tends to keep the capitalization of the corporation and the bond issues of the corporation within bounds, and prevents watering of stock to such an extent that a fair return upon the investment is not sufficient to pay interest upon bonds and dividends upon stock.

"Such an amendment also should contain a provision whereby no company could merge with another company or could become a holding company for another corporation without permission to do so from the commission. Such a provision would prevent a paying property from taking control of an insolvent property, or one which was not paying expenses, and thus would prevent the patrons of the solvent company bearing the burdens of an insolvent company."

EDWARD N. HURLEY TO ADDRESS ASSOCIATED MANUFACTURERS

Retiring Chairman of Federal Trade Commission Is to Speak at the Banquet on March 15 in New York

Extensive plans are nearing completion for the annual meeting and banquet of the Associated Manufacturers of Electrical Supplies, to be held at Delmonico's, New York, on March 15. Edward N. Hurley, retiring chairman of the Federal Trade Commission, will make an address at the banquet. A large concentration of meetings of sections in the week commencing March 12 will assure the transaction of business in many of the active lines in which the association is engaged.

In the list of scheduled meetings for March 13 and 14, published in last week's issue, a typographical error made it appear that all of the sections mentioned were to gather on one day. The correct list of committee meetings follows:

March 13.—Fan motor section, offices of the association, 10.30 a. m.; knife switch section, offices of the association, 10.00 a. m.; panelboard and switchboard, offices of the association, 2.00 p. m.; snap switch section, offices of the association, 2.00 p. m.; lighting fixture section, Hotel Biltmore, 10.00 a. m.; outlet box section, Hotel Biltmore, 2.00 p. m.

March 14.—Lamp receptacle and socket, offices of the association, 9.30 a. m.; fuse section, offices of the association, 2.00 p. m.; attachment plug section, offices of the association, 4.00 p. m.; committee on inclosed fuses, offices of the association, 9.30 a. m.; molded or formed insulation section, Hotel Biltmore, 10.00 a. m.; line material section, Hotel Biltmore, 2.00 p. m.; porcelain section, Hotel Biltmore, 10.00 a. m.

The interior lighting fixture committee of the lighting fixture section will meet on March 6, 1917, at 10 a. m. at the association offices, New York City.

The industry conference committee of the outlet box section will meet at the association offices, New York City, on March 12, at 10 a. m. The members of the committee are: H. G. Knoderer, National Metal Molding Company, Pittsburgh, Pa.; N. L. Otis, Chicago Fuse Manufacturing Company, New York; W. T. Ruete, Sprague Electric Works, New York; Edgar R. Slack of the Underwriters' Laboratories. The committee will consider various matters of standardization, prior to submitting a report to the meeting of the outlet box section at 2 p. m. on March 13, at the Hotel Biltmore.

McGraw and Hill Publishing Companies Consolidate

The McGraw Publishing Company, Inc., and the Hill Publishing Company have been consolidated as the McGraw-Hill Publishing Company, Inc. The new company acquires all the properties and interests of the two constituents, including the following technical journals:

"Electrical World," "Electric Railway Journal," "Electrical Merchandising," "Engineering Record, "Metallurgical and Chemical Engineering," "The Contractor," "American Machinist," "Power," "Engineering News," "Engineering and Mining Journal" and "Coal Age."

Two of these papers, "Engineering News" and "Engineering Record" will be consolidated under the name "Engineering News-Record," with Charles Whiting Baker, now editor of "Engineering News," as editor-in-chief.

James H. McGraw will be president of the new company, Arthur J. Baldwin (now president of the Hill Publishing Company), vice-president and treasurer, and E. J. Mehren, vice-president and general manager.

COMMONWEALTH EDISON COMPANY'S ANNUAL REPORT

In Spite of Rate Reductions and Increased Operating Expenses Earnings Are Nearly as Great for 1916 as for 1915

Earnings of the Commonwealth Edison Company of Chicago for the fiscal year ending Dec. 31, 1916, were equal to 9.59 per cent on the capital stock as compared with 10.09 per cent for the previous year. While the operating revenues, reaching $22,863,118.36 for 1916, increased $1,980,791 over 1915, the net income decreased $230,050, due to increased operating charges. The income account and balance sheet compares for 1915 and 1916 as follows:

INCOME ACCOUNT

	1915	1916
Operating revenue	$20,882,327	$22,863,118
Operating expenses	10,453,140	11,907,879
Depreciation reserve	2,442,078	2,822,174
Net operating revenue	$7,987,109	$8,133,072
Taxes and municipal compensation	1,582,089	1,835,912
Operating income	$6,405,070	$6,297,159
Other income	114,393	201,646
Total income	$6,519,463	$6,498,866
Interest on bonds	1,890,000	2,099,393
Net income	$4,629,463	$4,399,413
Dividends	3,677,110	3,667,112
Surplus	$692,353	$732,301

In his report to the stockholders President Samuel Insull said: "The company's business has continued to show constant growth, approximately 40,000 customers having been added to its circuits during the year. This represents an increase of 90,000 kw. The maximum load recorded at any one time was 369,740 kw., on Dec. 19, 1916.

"Owing to this growth in this business the company

has found it necessary to place orders for additional turbine capacity aggregating 142,500 kw. Some of these turbines will be installed during 1917 and some will not be delivered until 1918.

"In pursuance of its established policy to make voluntary rate reductions from time to time as found practicable, the company during the year reduced its net primary rate to lighting customers from 10 cents to 9 cents per kilowatt-hour. This change of rate went into effect in July, and resulted in a reduction in operating receipts, on the basis of the same output, for the remaining six months of the year of around $428,000.

"There was an increase in the operating expenses due to the high price of coal and of other materials, as well as to the greater cost of labor. By reason of the increased gross income the earnings show a satisfactory ratio, although a somewhat smaller amount has been carried to surplus than for the preceding year.

"The company has thought it advisable, in the past year, to make some increases of compensation to the most of its employees. These increases have been made with care, where they seemed appropriate, and not on any general or horizontal basis. There were in the service of the company on Dec. 31, 1916, about 5500 employees, of whom about 3490 had been in its service one year or more. Of these latter 3173 received increased compensation at a rate aggregating $35,131 per month, or an average increase of 15.3 per cent.

"Several times during the year conditions relating to the Chicago coal supply became threatening. It has been the policy of the company to carry in storage for emergency use substantially 250,000 tons (sixty to seventy-five days' supply) of coal at all times. This policy the company was able to maintain successfully, although at heavy expense. The company's coal consumption for the year was approximately 1,780,000 tons.

"There were issued during the year first mortgage 5 per cent gold bonds to the amount of $2,631,000, these being the remainder of an issue of $10,631,000 authorized by the State Public Utilities Commission of Illinois under an order made in 1915. On Nov. 9, 1916, the board of directors authorized the issuance of additional stock to the amount of 10 per cent of the existing stock. With the approval of the State Public Utilities Commission of Illinois, this was offered at par to stockholders of record Jan. 10, 1917."

GOVERNMENT NITRATE PLANT SOUGHT FOR AUGUSTA, GA.

Various Water-Power Sites Available for Developing Electrical Energy Cheaply and for Supplying Encampments

Favorable progress is reported by Augusta (Ga.) interests who are endeavoring to induce the government to locate a nitrate plant in the vicinity above Augusta, where there is available abundant electrical energy from the water powers of Georgia, particularly the developments at Calhoun Falls, Twin City, Anthony Shoals and the plants of the Georgia-Carolina Power Company along the Savannah and Broad Rivers. If the plans are accepted, history may repeat itself and munitions of war furnished to the American army from the same section and practically from the same waters that furnished energy for a factory that supplied the Confederate army during the Civil War. Augusta, it is hoped, may also be selected by the government for the location of a cantonment for 25,000 regular soldiers. In such a case the Augusta, Aiken Railway & Electric Company is prepared to extend its trolley lines and light and power service to meet the demands of such a camp.

NIAGARA POWER EARNINGS TOTALED $3,062,856 IN 1916

Annual Report of American and Canadian Companies Reviews Power Shortage Situation and Federal Action Thereon

Gross earnings of the Niagara Falls Power Company and Canadian Niagara Power Company for 1916 amounted to $3,062,835.68, an increase of $377,237.56 over the earnings for 1915. The increases in expenses and deduction were slight so that the 1916 surplus, which amounted to $1,362,116.49, was in excess of that for 1915 by $334,058.74. The combined comparative account for 1915 and 1916 follows:

	1916	1915
Sales of electric energy	$2,904,842.58	$2,536,757.42
Miscellaneous	157,993.10	148,840.70
Total operating revenue	$3,062,835.68	$2,685,598.12
Operating expenses	$507,641.23	$467,853.27
Amortization	120,000.00	120,000.00
Operating taxes	224,255.03	200,906.35
Total deductions from operating revenue	$851,896.26	$778,759.62
Net operating revenue	$2,210,939.42	$1,896,838.50
Rent revenue	45,830.71	39,239.28
Interest	127,286.30	145,108.25
Miscellaneous	4,506.40	2,212.95
Total non-operating revenue	$177,623.41	$186,560.48
Miscellaneous	10,371.04	8,000.07
Non-operating taxes	12,376.62	12,712.09
Total non-operating revenue deductions	$22,747.66	$20,712.16
Net non-operating revenue	$154,875.75	$165,848.32
Net income	$2,365,815.17	$2,062,686.82
Interest on funded debt	994,760.00	994,760.00
Miscellaneous	980.00	980.00
Paving Buffalo Avenue	7,958.68	38,889.07
Surplus	$1,362,116.49	$1,028,057.75

During the past year the power shortage brought about by the reduction of power from Canada, increasing demand and federal restrictions on the amount generated on the American side of the Falls was the most serious problem the system had to contend with. This situation is thoroughly reviewed in the report by President Edward A. Wicks, who said in part:

"The rapid increase in power use in Canada has led the Canadian government considerably to reduce its permits for the exportation of Niagara power. The export license of our Canadian company has been reduced from 75,000 hp. to 30,000 hp. from American industries despite insistent demands.

"The American plant has a generating installation some 15,000 hp. in excess of the amount of power that the federal government permits to be generated. That part of our generating plant has been condemned to idleness for most of the time since 1906, when the Burton act became a law, although by its own terms the law expired in 1913. The Secretary of War, however, continued the prohibition of that act.

"When, because of increases in power use in Buffalo and delays in the installation of the Buffalo General Electric Company's steam plant, the power situation in Buffalo became critical, the Secretary of War, upon urgent requests from Buffalo, issued special permits, effective a part of the year and terminating finally Jan. 1, 1917, for the operation of our American plant to nearly its full capacity during certain peak-load hours of the day, limiting the additional power so generated to use in Buffalo only, and, as before, restricting the production of the plant at all other hours in the day.

"Since the expiration of the permit on Jan. 1, 1917, the operation of the plant has again limited at all hours of the day to production as formerly restricted by the Burton act. The Secretary of War stated that he had no authority to extend or to revise the special permit of

1916, although he recognized the critical situation of industries at Niagara and in the much wider circle of industries throughout the United States dependent on Niagara power output. The Secretary of War suggested to Congress the passage of a joint resolution giving to him power to grant relief by permits for additional diversion in the amounts required to operate present installations, not in excess of the allotment to the United States under the provisions of its treaty with Great Britain.

"Upon this suggestion of the Secretary of War, and at the urgent request of power users at Niagara and those dependent on Niagara products in all parts of the country, a joint resolution introduced by Senator Wadsworth passed the Senate and also the House, but with an amendment in which the Senate declined to concur. The joint resolution authorizes the Secretary of War to grant temporary permits, expiring July 1, 1917, for the diversion within the treaty limits of additional water sufficient to operate in full the existing installations at Niagara. (Note—The resolution has become law and a permit has been issued for the diversion of an additional supply.)

"The date for the expiration of this temporary relief measure apparently has been made in expectation that legislation permanently controlling Niagara diversion would be enacted before adjournment. The Cline bill, for that purpose, has been reported favorably by the foreign affairs committee of the House of Representatives. The terms of that bill are not wholly satisfactory, but it is hoped that before final enactment they may be made less onerous. It is probable, however, that very large expenditures will become necessary so as nearly to double the amount of output of our power.

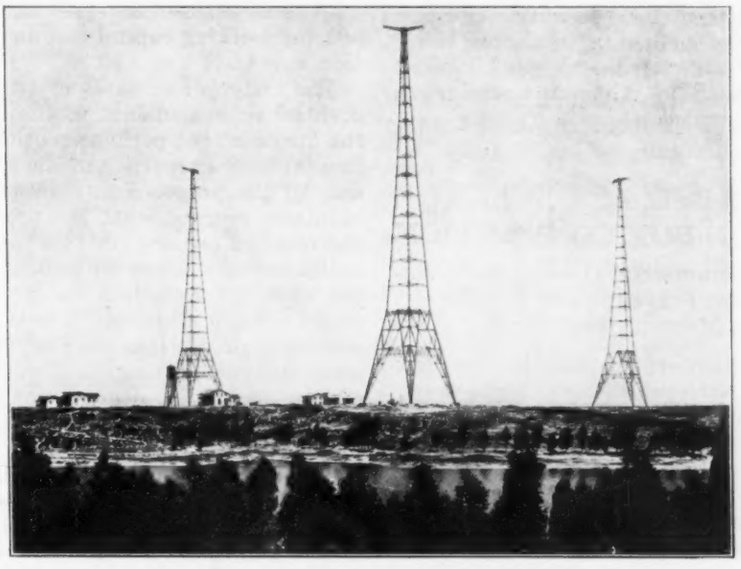
"It is highly important that there be enacted suitable legislation, settling permanently the questions of the control and regulation by the federal government of the use of the water of the Niagara River for the production of power, so that there may be a reliable basis for providing an adequate supply of power.

"In 1895 the Niagara Falls Power Company made its first delivery on a large commercial scale of electric energy in the form of alternating current for industrial uses. This also was the first of such deliveries in this country. Beginning with that great achievement the city of Niagara Falls has come to be the world center of industries dependent upon electric energy. Such concerns are the most important group of industries in the United States, for the reason that their products are indispensable to the basic industries of the country. The steel industry is dependent on the alloy ferro-silicon. Ferro-chromium is essential in the making of armor plate, armor-piercing projectiles and automobile steels and is used in all high-speed tool steel. Metallic silicon is necessary in the production of electrical steel. Without carborundum, alundum or the other electric furnace abrasives automobile factories and machine shops could not be operated."

SAN DIEGO NAVAL RADIO STATION IN SERVICE

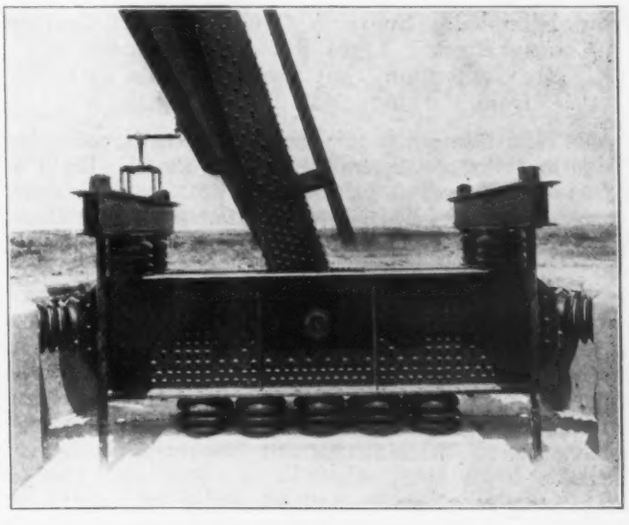
Operates on Poulsen System and Is Equipped with Three 600-Ft. Steel Towers for Aerials—Most Powerful Station Built

The radio station built for the U. S. Navy Department on Chollas Heights near San Diego, Cal., is now in regular service. The official trials began on Jan. 26, when Lieut. S. C. Hooper of the bureau of steam engineering, Navy Department, sent the first official message to Arlington, using a silver key specially prepared for the occasion. The power-house equipment was operated by L. F. Fuller, chief electrical engineer of the Federal Telegraph Company, and messages were exchanged between the Secretary of the Navy, California Congressmen, the Mayor of San Diego, and H. P. Veeder, vice-president of the Federal Telegraph Company. The plant is nominally rated at 200 kw., operates on the Poulsen system, and is the most powerful thus far put in service. Reports of its test announce that the new plant has far exceeded the government's requirements.



NEW GOVERNMENT RADIO STATION AT SAN DIEGO, CAL.

The aerial is carried by three 600-ft. self-supporting steel towers placed in a triangular position. In addition to the power house where the radio apparatus is installed, there are also a number of other buildings located on the area which the government has reserved in the vicinity of the station. The operating and office building is separate from the power house, and is provided with a soundproof operating room. There are also barracks for operators and several buildings for officers in charge.



TYPICAL INSULATED FOOTING OF THREE-LEGGED TOWER

This plant is the third in the chain of naval high-

powered radio stations of which Arlington was the first and Darien the second. Pearl Harbor and Cavite are next two in the progressive development, and these will have apparatus of much higher power than that installed at San Diego. The arcs for Pearl Harbor and Cavite weigh 65 tons each, and are the largest and most powerful pieces of radio apparatus ever built. All of these stations are being constructed by the Federal Telegraph Company and operated on the Poulson system. With the completion of this chain it is expected that it will be possible always to maintain communication between war vessels in the Atlantic or Pacific and Washington headquarters.

The accompanying photographs, showing a general view of the station and the method of insulating tower footings, were placed at our disposal by the Llewellyn Iron Works of Los Angeles, by whom the steel work used in the towers was supplied.

NEW ENGLAND N. E. L. A. QUESTION BOX CONVENTION

Research, Accounting, Commercial Development, Advertising and Accident Prevention to Be Discussed at Boston Meeting Next Week

A question box convention will be held by the New England section of the National Electric Light Association at the Engineers' Club auditorium, Boston, Mass., on March 7 and 8. Four sessions will be held, the convention opening at 10 a. m. each day, with afternoon meetings beginning at 2 o'clock. Among the topics to be discussed are heating research problems, accounting, commercial development, advertising and accident prevention. There will be no evening sessions, but there will be an opportunity to attend the Boston automobile show during the two days. W. A. Whittlesey, Pittsfield, Mass., is chairman of the Question Box Committee and the secretary of the New England section is Miss O. A. Bursiel, 149 Tremont Street, Boston.

NEW HAMPSHIRE COMMISSION OVERRULED BY COURT

New Hampshire Supreme Court Sustains Grafton County Electric Light & Power Company in Its Contention That Property Built Up from Earnings May Be Capitalized

The New Hampshire Supreme Court has issued a decision in favor of the Grafton County Electric Light & Power Company et al. vs. the State of New Hampshire on appeal from two orders of the Public Service Commission bearing upon the value of affiliated properties and the allowable capitalization in connection with their merger. The case has been in progress about four years, decisions of the commission having been reported in 77 N. H. 490 and 539. The commission found that the fair value of the property which the petitioner wished to capitalize was $165,000 as of Nov. 1, 1912; but as the petitioner declined to ask for an order permitting capitalization at this sum, the petition was dismissed.

The case is of quite special interest on account of the finding of the court that the test of value of a public utility is commercial worth; that all elements of value which a prudent investor would consider must be regarded; that reproduction cost is an important element, and that the price obtained at an isolated private sale is not controlling. Also, the ruling is important in its insistance that consideration must be given to going concern value and net earning capacity under customary rates, and that organization expenses, including expense of litigation before the commission and on appeal may be capitalized.

The court states that the question before it is not the amount of the property as a basis for rate-making, but what is the value of the property which in the exercise of their business judgment the company considers it wise to put into the business. The petitioner contended that the value is not less than $300,000. Considering all the evidence the court holds that the property proposed to be capitalized was fairly worth Nov. 1, 1912, $245,000. Since then $73,572 has been expended upon additions to the properties, which the court holds may be capitalized together with an allowance of $15,000 for working capital and an allowance for organization expense.

The criterion or basis of value is what a single individual with abundant means desirous of engaging in the business, but perhaps cautious in investment, would pay for such properties in the situation found upon the date of the proposed capitalization. Such a test must take into account what the property had actually cost the original owners (in this case the capitalization actually issued was low on account of the policy of having put earnings back into the properties); how much it would cost to construct a new plant to carry as economically on the business of the existing plant; how much less the existing plant would be worth than a new one on account of depreciation, inferior or antiquated construction; and what return upon the investment was probable.

The engineers retained by both the plaintiffs and the commission were in substantial agreement as to the cost of reproduction less depreciation. The court is inclined to give more weight to the cost of reproduction as testified to by the engineers than to the price paid for the property in 1912 by the interests in control of it. The court points out that the reproduction cost is the combination of the several market values of the plant components plus the cost of their combination. If the parties owning the plants economized upon construction and have enlarged and improved their property from earnings, such expenditures being concealed from view because never paid or charged to operating expenses, whatever the property is now worth is theirs. The concern of an intending purchaser would be the value of the construction on sale and not the manner in which the proposed seller obtained a valid title. When such property as this is sold privately with no competition, the sale furnishes only the opinion of the seller and the purchaser as to value. In the present case it is clear that the purchasers bought because they thought they were getting the property for less than its real market value.

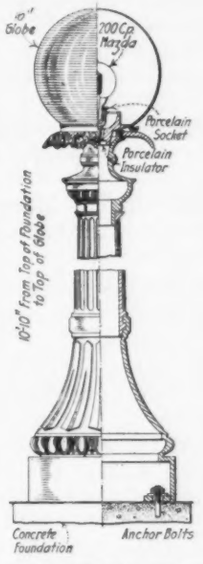
Neither is it material that the petitioners may make a profit by the transaction. If they bought for less than the value, the profit is theirs, as they would have had to stand the loss if they had paid too much. The fact that customers have been secured is an element of value, even if in the past this labor has been charged under operating expenses. Another element in value is the fact that the business is prosperous under existing rates which compare favorably with those throughout the state.

In addition the fact that the peculiar circumstances of this case may make the organization expense large does not alter the principle that proper allowance should be capitalized for legal expenses, including the reasonable cost of the litigation and all expenditures by order of the commission. By this decision the company wins a sweeping victory, the results of which are likely to be far-reaching in their effect upon New Hampshire regulative practice.

EXTENSIVE STREET LIGHTING IMPROVEMENTS AT NEW ORLEANS

Magnetite Arc Lamps and Gas-Filled Tungsten Lamps on Ornamental Posts Will Displace Older Street Lighting System in Crescent City

Construction is now under way at New Orleans for the extensive installation of new street lamps, according to M. S. Sloan, general manager, and V. L. Willoz, superintendent of electrical distribution, New Orleans Railway & Light Company. This work has resulted from the closing of a ten-year contract between the electric service company and the city. Magnetite arc lamps rated at 5.5 amp. will be used in most places, about 4000 units being contemplated for installation within the year. On sections of the boulevards and principal avenues of the city it is intended to use about 2000 gas-filled tungsten lamps mounted on ornamental poles like the one shown in the accompanying drawing. The lamps will be rated at 7.5 amp. and 250 cp. and will be incased in 16-in. globes. The posts supporting them will be placed about 90 ft. apart. In the business section double-lamp standards will be installed. The job calls for the installation of 40 miles of concrete-incased duct. Two and one-half inch and 3-in. fiber duct will be used. Individual transformers will be installed in the base of each lamppost.



ORNAMENTAL POSTS USED IN NEW ORLEANS SYSTEM

The one-lamp poles measure 10 ft. 10 in. high from the ground level to the top of the globe. Between the lamp socket and the top of the pole is a porcelain insulator shaped as shown herewith. Vents are provided in the cap to which the globe is clamped for the escape of heated air. The bases of the lampposts are fastened to anchor bolts cast in 24-in. by 24-in. by 24-in. concrete footings. A hole is left in the center of each footing for the reception of the lamp transformer. Between posts the ducts are incased in 3 in. of concrete.

COLUMBUS UTILITY PLANS EXTENSIVE IMPROVEMENTS

New Station to Take Care of Entire Load, and Costing Approximately $1,000,000, to Be Erected Outside the City

Plans for extensive improvements have been made by the Columbus (Ohio) Railway, Power & Light Company. The chief feature of the plan is a big central station on the Hocking Valley Railroad, 6 miles south of the city, to cost in the neighborhood of $1,000,000. Its consummation depends upon the consent of the Public Utilities Commission to the issue of $1,640,379 of new securities and this will doubtless be forthcoming, since the company asks for nothing which its business does not require. The erection of the proposed station will mean the abandonment of the Third and Spring Street stations and the concentration of its productive operations in the new station.

The company has secured 15 acres of land, plans for the station have been completed and orders for some of the equipment have been placed. Right-of-way for the transmission lines has been secured and, with the consent of the commission, the company is ready to begin work in time to have the station in operation in the coming fall.

A portion of the money to be raised by the sale of the securities will be used in the purchase of equipment and cars for the railway department. The company will also ask for authority to sell securities for refunding about $500,000 improvements made in 1915. This money will be used in operation and in otherwise putting the utility in first-class condition.

CONTROVERSY OVER NAVAL ELECTRIC SHIP PROPULSION

Dr. Schuyler Skaats Wheeler Criticises the Government Plans—Frank J. Sprague, Member of Naval Consulting Board, Defends the Designs

A controversy has developed over the plan of the Secretary of the Navy to introduce electric propulsion on an extensive scale in naval vessels. Dr. Schuyler Skaats Wheeler, president of the Crocker-Wheeler Company, has written letters to the New York daily newspapers criticising the action of the Navy Department and advocating an independent investigation by a committee of engineers. The position of Dr. Wheeler, which he has expressed also to members of Congress, is that without more actual experience the designs involve a dangerous experiment with the country's defenses. Dr. Wheeler is supported by other engineers in his protest.

The criticisms of Dr. Wheeler and others who have joined with him in the movement have been answered by Frank J. Sprague, who is a member of the Naval Consulting Board and chairman of its committees on electricity and ship construction.

CRITICISMS OF DR. WHEELER

In his letters Dr. Wheeler says:

"What is meant by the electric drive can best be understood by saying that the cruisers are each to be equipped with engines of 180,000 hp., which power in the ordinary type of ship would be transmitted to the propellers by mechanical gears. In the electrically driven battle cruisers, however, this mechanical power, produced by the same boilers and substantially the same turbines, is transformed into electric power with the aid of four dynamos of enormous size, and capable together of producing 180,000 hp. of electricity. Then this electricity is to be reconverted into mechanical power with the aid of eight motors, having together 180,000 hp., the motors being directly connected to the propeller shafts.

"These huge electrical machines, carrying enormous currents of electricity, with their appurtenant cables, rheostats, switches and switchboards, and other complicated electrical apparatus, bulky and at the same time delicate, likely to be short-circuited, cut by splinters or otherwise, and in many other ways put out of service, are a new and almost wholly untried experiment. No other country is using electric drive for its warships. We have tried it on a small collier, the Jupiter, of 6500 hp., and the Navy Department's reports show that this collier is run at a high cost.

"The opponents of the electric drive point to the increased cost and to these facts: That it adds 1000 tons more weight to the ship's machinery and to the total net weight of the ship; that it necessitates placing half of the boilers on an upper deck above the protective deck —a most extraordinary innovation in marine architecture, and one which exposes the boilers to direct gun-

fire; that it involves the use of seven smokestacks instead of three, thus seriously interfering with the lookout and gunfire, and presenting a much better target to the enemy's ships, which now fire before the hull of the ship aimed at is seen from the deck.

"Great stress should be laid on one other feature, which is particularly objectionable, namely, that the electric drive involves a three-cornered contract."

Mr. Sprague Defends Flexibility of Operation

Mr. Sprague, in a letter to Claude A. Swanson, chairman of the committee on naval affairs of the United States Senate, says:

"The discussion seems to have concerned itself with two objects: One seeks to condemn the adoption of electricity on the score of increased weight and cost, or the impossibility of construction or safety in operation. The other seeks a reference of the whole matter to the Naval Consulting or some other board to determine whether an electric plant of the size projected can be built and operated, and, assuming that a geared turbine plant can also be built and the difference in cost and weight are such as are indicated in the preliminary bids, to advise which system shall be adopted.

"Unless the department was absolutely convinced of certain facts it could of course very properly have called for some outside advice, but there is a distinct limit to such reference. For example, if desiring to reinforce the statements of the bidders on electric machinery it might have put limited inquiries to a committee of a professional organization, or to selected outside experts, as to whether a turbine-driven central station of 180,000 hp. to operate eight 22,500-hp. motors could be safely constructed and operated, and submitted to sufficient tests prior to actual installation in a ship.

"To this there could be but one possible answer by anyone familiar with actual manufacture or possessed of adequate professional experience.

"On the other hand, the query might have been made as to whether it is possible to build and operate geared turbine equipment aggregating 45,000 hp. per shaft, either divided into two or four units for each shaft, and whether such could be submitted to like crucial tests before installation.

"Assuming that a favorable reply to both these inquiries could be had, and that instead of assuming on the one hand that electric equipment of the required power cannot be built but that geared turbines can be, or on the other hand that electric equipment certainly can be constructed, while it is doubtful if geared turbines can, we accept the fact that both are possible. What then? Let us assume, further, that when compared it is found that there are known differences of costs and weights against the electric equipment, and certain structural differences inherent to each, a large number of which have not been publicly discussed, and which it would seem unwise to open for general discussion at this critical time, when the spreading broadcast of the detail construction of these ships may well be gravely questioned.

"Right here any possibility of decision by outside civilian engineers must halt, for it is inconceivable that with all the known facts in hand the Navy Department could or would surrender to outside advisors, directly or even inferentially, the selection between two known and accepted methods of drive, with their varying influence upon the distribution of weights, location of turrets and armor, size and disposition of compartments and the results of flooding, the distribution of fuel, the distances of machinery from the skin of the ship, provision against torpedo damage, the necessities of handling ships in emergencies and the results of failure of any parts. With these in hand there can be no proper decision except through the proper governmental agencies. Nor is there a single engineer in the lay world who is warranted in taking upon himself any such decision.

"Herein lies the difficulty of any general reference, proper at any time if the department so elects as to facts regarding the possibility of construction and operation of engines, whether electric or turbine, but the decision as to which of two possible drives shall be adopted, and the part they play in the whole question of ship construction and operation in peace or war must stay where it now rests.

"I do know, in spite of any statements to the contrary, whatever the authority, that generators and motors of the size indicated can be built, and that if necessary they can even be controlled by a push button from the bridge."

ACT TO LICENSE NEW YORK JOURNEYMEN ELECTRICIANS

Bill One of Many Introduced at Albany Calculated to Enlist New Means of Creating Revenue

Senator Graves of Buffalo has introduced in the New York State Legislature under Senate print No. 620 a bill entitled "An act relative to licensed journeymen electricians designing to install wires of apparatus for electric light, heat or power purposes."

There is no provision in the proposed law to the effect that the payment of the license imposed to the State, shall exempt the holder of such license from the payment of any local fee for registration or otherwise. The bill is in line with other measures recently introduced at Albany calculated to enlist new means of creating revenue and is said to have the tacit support of the administration. A time for a public hearing on the measure has not at this writing been set.

Sec. 1 provides that on and after Sept. 15, 1917, no person shall work as a journeyman electrician unless such person shall have received a license. The section defines a "journeyman" as a person who does any work of installing wires, conduits, apparatus, fixtures and other appliances. Sec. 2 provides for the appointment by the Governor before July 1 of a commission of three, who shall be wage earners, citizens of the State and who have had at least ten years' practical experience, fixes their compensation and term of service and provides for the holding of examinations.

Sec. 3 of the act provides for the exemption from examination of persons who present proof of five years' experience, for the granting of licenses on examination, fixes the fee for examination at $5, provides for an annual renewal of license at $2.50 and stipulates that holders of license shall carry evidence of their having been so licensed. Sec. 4 prohibits the transfer of a license and provides for its revocation. Sec. 5 states that "Any violation of this act shall be deemed a misdemeanor." Sec. 6 gives fees and fines to the State treasury.

Sec. 7 provides for exception of electrical equipment in connection with railroads, generating stations, substations, storage battery stations, service switches and controlling devices, etc. Sec. 8 regulates the employment of apprentices and stipulates that a traveling theatrical electrician, who is not a duly licensed journeyman electrician may install temporary wiring and appliances, subject to the supervision of a person licensed under the provisions of the act.

Sec. 9 imposes a penalty for misstatements in application for a license. Sec. 10 repeals all acts or parts of acts at present on the statute books inconsistent with this act. Sec. 11 gives the time the act is effective.

REPORT ON THE PROPOSED PORTLAND MUNICIPAL SYSTEM

Commissioner Daly Files Detailed Statement Providing for Expenditure of $1,777,000 for Hydroelectric Plant and Lines

Commissioner Will H. Daly of the Department of Public Utilities has completed a detailed report of a proposed municipal electric lighting system, for lighting the streets and public buildings of the city of Portland, Ore., which he recently filed with the City Council, with the recommendation that the city attorney be instructed to prepare a charter amendment, to be presented to the voters of the city, at the municipal election in June, providing for the issuance of $1,777,000 in bonds, for the installation of the system. Of the proposed bond issue, $770,000 is for the generating system and transmission lines, and $1,000,000 is for the installation of a modern system of street lights in Portland. Commissioner Daly further recommends that the charter amendment be so drawn that the system will be self-supporting.

In his report he sets forth that the city is now paying approximately $200,000 a year to the Portland Railway, Light & Power Company, under contract for lighting the streets and public buildings in the city. There are 3553 arc lights now in service, and he says the system is becoming obsolete and unsatisfactory. He favors the installation of a more modern system of lighting, particularly post lighting. He also believes the city should take over the maintenance of all downtown street light and post lighting, now being maintained by merchants and property owners. With 2500 of the horsepower which may be generated in a municipal plant, he says he will be able to give Portland 5000 arc lights or their equivalent, for the same amount of money that is being paid for the illumination the city is now receiving, and that the rate for illuminating the public buildings with incandescents can greatly be decreased. The surplus 2500 hp. of energy he proposes selling.

The rate for residence lighting he suggests could be fixed at 5.5 cents per kilowatt hour for the first 45 kw.-hr., and 2 cents for each additional unit. For business lighting, he suggests a flat rate of 4.5 cents per kilowatt-hour, and 3.5 cents for power purposes. With the amount now being paid by the city for illumination, and with the sum which may be received from the sale of only 30 per cent of the surplus power, there would be an income into the lighting fund each year of $384,770. He estimates that the expense of operation and maintenance, including sinking fund and interest on bonds, at $327,682, which would leave a surplus and profit from the plant of $57,088 a year, and if the entire surplus of power was sold, the profits would be much larger. Commissioner Daly's recommendation comes as a result of extensive investigation of the feasibility of a light and power generating plant in connection with impounding dams in the Bull Run reserve, to conserve Portland's water supply.

The project includes the following: Area of watershed, 53½ square miles; water available, with storage, 108 second-feet; length of flume, 13 miles; capacity of reservoir, 4,000,000 cu. ft.; length of penstock, 3000 ft.; effective head, 650 ft.; horsepower available with storage (twenty-four hours per day), 6380; transmission line, 30 miles.

The power house will be 60 ft. by 100 ft. concrete building. As now proposed the transmission lines will carry a current of 66,000 volts and consist of a pole line carrying three No. 4 copper wires Delta system, 72 in. between wires. A telephone system will be strung on poles below the power lines.

The cost of this hydroelectric plant will be in the aggregate $1,777,000, being segregated as follows: Diversion, $27,500; flume, $286,000; right-of-way, $1,320; forbay and reservoir, $55,000; penstocks, $82,500; wagon road, $22,000; power house, $49,500; machinery, wiring, etc., $170,500; transmission, $82,500; distribution system, including transformer station, $1,000,000; total, $1,776,820.

COST KEEPING DISCUSSED BEFORE CONTRACTORS

M. A. Curran Emphasizes Importance of Increasing Turnover Rate and Cutting Down Superfluous Expenses

The importance of cost keeping and the best methods of handling accounting problems were discussed at a meeting of the Electrical Contractors Association of Massachusetts in Boston on Feb. 21 by M. A. Curran, general credit manager, Western Electric Company, New York. About 150 electrical contractors convened for a meeting and dinner at the Quincy House, with President A. J. Hixon in the chair. In his paper, Mr. Curran touched upon the principal weak spots in business administration exhibited in the electrical contracting industry, emphasizing the vital importance of increasing the rate of capital turnover, cutting down superfluous costs and adhering to accepted modern methods of billing, credits and collections. Investment in stocks far beyond the contractor's or dealer's early prospective needs was criticized and the reduction of personal calls in bill collections from satisfactory customers was urged. Billing by mail, even in small towns, was advocated. The author pointed out that the retailing of electrical supplies, which is now handled to a great extent by the contractor-dealer, requires business capacity of a higher type than the ordinary wiring business. The retail supplies carry a higher rate of profit and the overhead cost can generally be absorbed in the present overhead. It is advisable, however, to separate the accounting on the contracting from the retail business.

Modest investment in office equipment and quarters proportionate to the volume of business were recommended by the speaker, who incidentally said a few words about the opportunities before the contractor to suggest additional outlets in residential wiring, leading sometimes to increased income and augmented appliance sales. The cost of electric wiring and fixtures is so small a proportion of the total cost of a house that it virtually amounts to the salt at a banquet, and often can be increased to the mutual benefit of the house owner and the contractor.

In closing, the speaker pointed out that incompetence with the electrical contractor is not of the technical kind. He knows his trade, how to wire houses and make the electrical equipment furnished operate; but the kind of competence needed is business competence, and that means the broad education which the wireman must acquire to properly hold his place in the business community. That competence embraces the knowledge of costs, accurate estimating, prompt billing and collecting, paying of bills, and the accounting of the business as a whole. To many contractors the credit man may appear as a watch dog solely maintained to worry in the money by his barking and biting abilities. That type of credit man cannot stand in the present business scheme of things. To-day he must be an upbuilder, a generative force, and not merely a brake. He recognizes that his customer's welfare is his and that welfare is based on co-operative action and not on dictatorship.

Commission Rulings

Important Decisions of Various State Bodies Involving or Affecting Electric Light and Power Utility Operation and Practice.

Efficiency of Utilization of Facilities Sought—The California Railroad Commission has dismissed the complaint of the Coast Counties Gas & Electric Company that the Sierra & San Francisco Power Company is illegally, and against the commission's order, building an electric power line in San Benito County to supply electricity to the Old Mission Portland Cement Company, and has dismissed the application of the Sierra company for authority to build this line and otherwise sell electricity in San Benito County under a franchise granted by that county.

The Sierra company admitted that the Coast company sold electricity in San Benito County near San Juan Bautista, and stated that the Sierra company had begun the building of an electrical line to the cement plant. It said that it had a franchise to do this and that it did not intend to build a general distribution system in San Benito County. It said that it had a contract with the predecessor of the cement company which it was continuing.

The commission found that the Coast company, to serve the cement company, would be required to make a large investment in new lines and equipment. Its expense alone would be $46,000, and a line would duplicate existing lines. The commission in its order, therefore, seeks the highest efficiency in the utilization of the facilities of both utilities before additional investment is made in the territory.

Commission Approval Must Be Secured Though Line Be on Private Property.—The Public Service Commission for the Second District of New York has settled the disputes between the Colliers Light, Heat & Power Company and the Oneonta Light & Power Company over territories in the town of Oneonta, surrounding the village of Oneonta. The application of the Colliers company for approval of its franchises in the town of Oneonta so far as it relates to that part of the town south of the Susquehanna River and that part of the town east of the village, along the Oneonta - Cooperstown Highway, is denied. The Oneonta company is at present operating lines in these territories. The Oneonta company, on the other hand, is ordered to forthwith cease its operations in Oneonta Plains, where the Colliers company has a franchise, approved by this commission some time ago. The third order in these proceedings approves of the transfer of the electric line and the franchise therefor extending from the village of Oneonta to and beyond the Morgan Farm, from Mr. Morgan to the Oneonta company.

Interesting applications of the Public Service Commissions Law are laid down in both of the opinions. In sustaining the complaint of the Colliers company against the operation by the Oneonta company of a line in Oneonta Plains, the commission held that the fact that this line is wholly upon private property does not relieve the Oneonta company from the necessity of securing the approval of the commission before it can construct or use an electric plant. Even though the fact that the lines are on private property may make it unnecessary or impossible for the local authorities to grant a franchise, the commission showed that the Public Service Commissions Law requires the consent of the commission before an "electric plant" may be constructed, and this consent the Oneonta company has never obtained.

Upon the application of the Colliers company for approval of its franchise east and south of the village, the commission applied the broad principle that the interests of the community must come first and that the community may best be served in this territory contiguous to the village by the company operating in the village rather than by the Colliers company, which would have to build lines from 7 to 9 miles long. It suggested that good business policy would not warrant the construction of these lines only to secure the patronage possible, but that they are probably dictated by a desire of the Colliers company to surround the territory of its rival. The commission said in the strongest terms that this rivalry between the two companies should cease and the territory reasonably divided.

It developed on the hearing that the residents of both the east and south sides of the town were desirous of being served by the Oneonta company. It also developed that the Oneonta company was supplying electricity over lines owned by private individuals on the south side of the river and without a franchise. Testimony showed that the franchise of the Colliers company for the whole town of Oneonta was granted by the village board because the Oneonta company was not *persona grata* with it on account of more favorable negotiation in other matters which the board had had with the Colliers company. The commission held that the Oneonta company should at once cease operation in the southern part of the town, where it had no franchise, but also expressed the hope that the town board will see fit to grant the Oneonta company a franchise for that territory, as it is the territory which for reasons of economy and convenience it is entitled to serve.

In the other opinion the commission also criticized the agreement between the Ceperly-Morgan real estate company and the Oneonta company whereby the Oneonta company's lines are run on the laid out streets of the real estate development, and said that the agreement is so discriminatory against the company's customers in the village of Oneonta that the commission should order the agreement abrogated were it not at this time ordering the company to give up this business altogether.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public-utility companies.

Reasonable Exercise of Authority by Commission.—An order of the Public Service Commission, made on petition of a telegraph company, requiring a traction company, owning its right-of-way, to remove its high-tension power wires from dangerous proximity to telegraph wires, did not exceed the constitutional powers of the commission, as being confiscatory of the traction company's property and a taking without due process of law, it was held by the Supreme Court of Vermont (99 A. 4), private ownership of its right-of-way not giving the traction company the right to erect its high-tension line thereon without regard to the rule restricting every man against using his property to the prejudice of others. The findings of the commission having the force and effect of reports of special masters in courts of equity, are conclusive in the Supreme Court on appeal. Where the commission determined the necessity of an elimination of the danger in the close proximity of the wire, it was within the power of the commission to determine the manner in which the elimination could best be accomplished, with a view to the operation of both lines and to the public safety.

Employer Not Liable for Damages if Sufficient Warning Is Given.—Where a person killed by contact with a high-powered wire was a well-developed man physically and mentally, who had never clipped cable in proximity to high-power wires, but was not without experience in the construction of telephone lines, and was repeatedly warned as to the danger, and that contact with the high-power wires near which he was to work would kill him, the telephone company was not guilty of actionable negligence in directing him to ascend to the pole, since an employer is not an insurer of his employee's safety, and is liable for the consequences, not of danger, but of negligence in failing to adequately instruct an inexperienced employee as to unknown danger, it was held by the Supreme Court of Appeals of Virginia (90 S. E. 636). The lineman having been fully instructed and warned as to the danger, his death was proximately due to his own disregard of repeated warning, for which self-imposed injury the law affords no redress. As the burden was on the plaintiff to prove negligence alleged in failure to instruct the deceased in the use of a belt in which he was sitting, in the absence of evidence to the contrary, the defendant is presumed to have discharged his duties in furnishing safe place and appliances and giving necessary warning.

Would Make 50 Cents Legal Minimum Monthly Charge in Ohio.—Representative Cable has introduced a bill in the Ohio Legislature which provides that 50 cents shall be the minimum monthly charge for electric light contracts and it also prohibits an increase in the charge for energy by reason of this established minimum.

Electric Light Guards Treasury Gold.—For the better protection of the huge amount of bullion now stored in the Sub-Treasury and Assay Office located on Wall Street, New York, these buildings are now brilliantly illuminated within and without by high-powered arc lights, for the first time in the history of these institutions.

Lower Rates for Baltimore.—The Consolidated Gas & Electric Company of Baltimore, Md., has announced a reduction in the local electric rate from 8.5 to 8 cents per kilowatt-hour, with monthly minimum also reduced from $1 to 75 cents, effective after the April meter readings. The reduction is voluntary and will represent a saving of about $200,000 per year to consumers.

Bill to Allow Municipalities to Lease Public Utilities.—A bill has been introduced in the Senate of the Pennsylvania State Legislature to permit agreements between corporate and municipally-owned public utilities, providing that the council or governing body of any city, town or borough may acquire by lease an electric light, heat and power plant, or any water works or other utility, with term of lease at the option of the council or governing body. The utility or utilities so acquired are to be conducted as though the property by purchase of the municipality, with establishment of rates under the jurisdiction of the council or governing body.

Brooklyn Edison 1916 Growth Statistics.—The annual Progress Report containing statistics of growth of the Edison Electric Illuminating Company of Brooklyn shows that 1916 was a very gratifying year. The largest increase was in the power bureau, where 50,897 hp. was written in approximately 1500 contracts, an increase of 56 per cent over 1915; 21,000 hp. was signed in new installations, each one of which was in excess of 150 hp.; and 10,000 hp. was signed replacing private power plants. The report shows that forty-one large power plants were closed down and twenty gas engines. The lighting salesmen signed up over 77,000 50-watt equivalents in lighting, a gain of 10 per cent over 1915. The new installation bureau, in charge of house and store wiring, closed 1524 contracts, or 119 per cent better than in 1915. The house-wiring business was especially good—1042 contracts having been taken, or 141 per cent increase over the preceding year. The appliance bureau reports sales of over $107,000, as against $63,000 in 1915, a gain of 69 per cent in 1916 over 1915. The energy sold in 1916 were 187,000,000 kw.-hr., as compared with 143,000,000 in 1915, a growth of about 30 per cent. The increase in number of customers was 11,671 in 1916 over 1915, or 25.2 per cent gain.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Two-Cent Rate for Kansas City.—The commissioners of Kansas City, Kan., announce that there will be a new 2-cent rate on energy for cooking and lighting. The old rate of 6 cents a kilowatt for lighting and 3 cents a kilowatt for cooking, flat rates, are to be supplanted by the new architectural rate. This rate is on the basis of 5 kw. a room a month at 6 cents a kilowatt-hour, and all consumption above the 5 at 2 cents a kilowatt-hour. The minimum monthly rate will continue.

Electric Company Endeavoring to Invade Town with Municipal Service.—On Feb. 14, Mayor John A. Holtzenberger of Hamilton, Ohio, appointed a citizens' committee, consisting of F. J. Sloat, Joseph C. Strategier, S. M. Goodman and C. E. Mason to investigate the reported attempt of the Ohio Gas & Electric Company of Cincinnati to invade Butler county and the city of Hamilton with a line of poles and wires to compete with the municipal light plant. The commissioners of Butler county refused the company a franchise, but it holds it has a right to plant its poles on private property which it has acquired.

Over-All Efficiency in Industrial Heating.—In an editorial on page 163 of the Jan. 27 issue of the ELECTRICAL WORLD, H. J. Kunz of the Toledo Railways & Light Company was quoted as follows: "In some cases the thermal efficiency of the electric application (in industrial work) may be lower than the thermal efficiency of other sources of heat, but the over-all efficiency of the operation is very much higher than that obtained in any other way." This statement should read, "The actual cost of heat in any electric heating application may be higher than with some fuel, but the over-all cost will be lower in a great number of cases."

Public Utility Franchise Tax Bill for New Jersey.—The proposed franchise tax bill covering the earnings of electric, gas and water companies in New Jersey has been introduced in the Legislature by Assemblyman Oliphant. As a result of several hearings, revisions have been made in the bill as initially planned. The new law, which is an administration measure and destined to pass, exempts from its provisions all utility companies with gross receipts of less than $50,000 a year. For all other companies the bill stipulates a franchise tax of 3 per cent for the present year, 4 per cent in 1918 and 5 per cent in 1919 and thereafter, gradually increasing, year by year, the present rate of 2 per cent to this maximum. The bill is estimated to yield $1,000,000 in increased taxes to the different municipalities in the State.

City Cannot Regulate Telephone Rates.—Judge E. B. Kinkead of the Common Pleas Court in a decision rendered on Feb. 19 held that the city of Columbus, Ohio, has no authority to regulate telephone rates, but that this power lies with the Public Utilities Commission only. He also held that the contract for free telephone services for city governmental purposes is illegal, and declared that the city cannot enforce such a contract. The decision was given in the suit to restrain the Ohio State Telephone Company from increasing its service rates.

1917 Electrical Show, University of Illinois.—The University of Illinois will hold its sixth biennial electrical show on April 12, 13 and 14, in Urbana. This show is prepared and managed entirely by students in the Department of Electrical Engineering of the University, and while the principal object is to demonstrate the ability and resourcefulness of the student body, special emphasis is being placed this year upon the influence of electricity in the smallest, as well as the largest, details of modern life. An electrically propelled monorailroad, the use of electricity for stage effects, and an "electrical dog" are some of the features.

New Jersey Superintendent of Weights and Measures Would Test Gas and Electric Meters.—In a statement to the Governor, William L. Waldron, New Jersey State superintendent of weights and measures, has requested an enlargement of the scope of the work of the department to include the testing of electric, gas and water meters. It is proposed to eliminate this feature from the province of the Board of Public Utility Commissioners and revising the present plan of a consumer charge of $1 for requested tests, which is returned when the meter is found to be incorrect, and which, it is held, deters consumers from asking tests. It is suggested that this charge be eliminated and that the utility companies owning the meters pay a nominal sum for inspection. With this plan the public utility companies would be relieved from making meter tests.

Milwaukee Receives Lower Offer to Supervise Lighting System Construction.—Mayor Hoan and Commissioner Simmons of Milwaukee have sent a letter to the City Council withdrawing their recommendation that F. A. Vaughn be retained as engineer to supervise construction of the municipal lighting system. The proposal, which was under consideration by a committee of the council, was that Mr. Vaughn be retained at a salary of $10,000 a year. Arthur J. Sweet, formerly a partner with Mr. Vaughn in the firm of Vaughn, Meyer & Sweet, has offered to supervise the work for $3,000 a year. It was this firm that, while both of the engineers mentioned were members of it, designed the system which the municipality is proposing to install. In withdrawing the previous recommendation Mayor Hoan recommends that the sum for completing the work be made not only "as reasonable as possible but not to exceed $3,000."

Factory Lighting.—Prof. C. E. Clewell of the University of Pennsylvania read a paper on "Factory Lighting" at the Feb. 16 meeting of the Chicago Section of the Illuminating Engineering Society.

Cleveland Electrical League. — Frank Goewey Jones, former president of the American Electric Fuse Company and former convict, addressed the members of the League at their noon luncheon on Feb. 15 on "Another Million-to-One Chance."

National Capitol Company Section, N. E. L. A., Formed.—This section, which is composed of members of the Potomac Electric Power Company, was formed on Feb. 9 with the following officers: John C. McLaughlin, chairman; J. H. Ferry, vice-chairman; H. A. Brooks, secretary, and E. W. Whitehead, treasurer.

San Francisco Electrical Development and Jovian League.—A smoker held by this organization in San Francisco on Feb. 15 was attended by about 200 members for whom a lively program had been prepared, including a variety of entertainment. Prizes in the shape of electric irons, lamps and flashlights were distributed. Three addresses were also made, Albert E. Elliott on "Service," Tom Collins on "The Accomplishments of the Jovian Order," and Henry Holland on "The Opportunities for the Electrical Development and Jovian League."

Farewell Luncheon to J. E. Davidson. —The American Institute of Electrical Engineers, National Electric Light Association and Oregon Society of Engineers, Portland, Ore., sections, at the eighth bi-weekly luncheon, Feb. 14, were addressed by Franklin T. Griffith, president of the Portland Railway, Light & Power Company. The luncheon was a farewell tribute to J. E. Davidson, past chairman of Portland section, N. E. L. A. Mr. Davidson has been general manager of the Pacific Power & Light Company for the past five years and is leaving Portland to accept an executive position with the Electric Bond & Share Company of New York.

Electrical Engineering Fraternity Convention.—The thirteenth annual convention of Eta Kappa Nu, an honorary fraternity of electrical engineering students, will be held March 16 and 17, 1917, at the University of Illinois. Delegates from the following institutions will attend: University of Illinois, Purdue University, Ohio State, Case, Cornell, Pennsylvania State, University of Pennsylvania, University of Wisconsin, Armour Institute, University of Missouri, and the University of California. In addition the following Alumni chapters will be represented: New York, Pittsburgh, Schenectady, Chicago, Milwaukee and St. Louis. All alumni members in the vicinity of Champaign are asked to attend this two-day meeting. Prof. L. H. Harris, University of Pittsburgh, is secretary of the national executive council and is in a position to furnish any desired information.

Associations and Societies

The Directory of Electrical Associations, which is regularly printed in the first issue of each month, appears on page 447 of this number.

New Orleans Jovians Plan Rejuvenation.—Plans have been laid by the New Orleans Jovian League for the annual banquet and a rejuvenation on March 17. At the luncheon meeting on Feb. 6 Harold W. Newman, commissioner of public safety, spoke on the "Electricity and Its Importance to the City." The league is making arrangements to assist the local contractors in the entertainment of the delegates to the annual convention of the National Electrical Contractors Association to be held this year at New Orleans.

Residence Lighting. — "Residence Lighting" will be discussed by the New York section of the Illuminating Engineering Society on March 8 at the auditorium of the Consolidated Gas Company, New York City. There will be two papers. H. H. Newman, agent of the Public Service Gas Company, Trenton, N. J., will speak on "Maintenance," and Paul L. Zoellner, secretary of the Nichols Gas Fixture Manufacturing Company of Brooklyn, will discuss the "Development of Lighting Fixtures." There will be a display of lighting fixtures, and the show rooms of the Consolidated Gas Company, the New York Edison Company and the Municipal Lighting Company will be opened for inspection to those attending the meeting.

Ohio New Business Convention.—The next convention of the committee on new-business co-operation of the Ohio Electric Light Association will be held at the Miami Hotel, Dayton, on March 14. The following program has been arranged: Address of welcome by Judge E. P. Matthews, vice-president the Dayton Power & Light Company; "Financing Motor Installations," by F. I. Woltz, power engineer, Union Gas & Electric Company, Cincinnati; discussion by F. B. Steele, H. B. Craft, G. A. Mau; "Free Service" by O. A. Acuff, new-business manager, Massillon Electric & Gas Company; discussion by O. B. Reemelin, C. E. Yacoll; "Salesmanship," by A. F. Siebert; "The Manufacture of Raw Water Ice," by A. M. Heritage, refrigerating engineer, Triumph Ice Machine Company, Cincinnati; discussion by W. B. Wilkinson, J. C. Matthieu; "Commercial Rates," by E. T. Hollingsworth, commercial manager, Ohio Light & Power Company, Newark; discussion by W. A. Wadsworth, L. J. Lemen, H. F. Heyman; "Motion Pictures as An Aid to New Business" by F. H. Hooper, new-business manager, Northwestern Ohio Light Company, Van Wert. In the evening a banquet and cabaret will be held at the hotel under the auspices of the Dayton Jovian League.

Dallas Electric Club and Jovian League.—Ell C. Bennett, Mercury of the Jovian Order, addressed the local order on Feb. 19.

Founder of Cleveland Electrical League Honored.—At a meeting of the stockholders of the Cleveland Electrical League on Feb. 22 the first perpetual membership was awarded to J. Robert Crouse, its founder. In resolutions adopted at the time Mr. Crouse was designated as the father of electrical co-operation. An original patriotic poem was given by William Ganson Rose and addresses were made by President N. H. Boynton, former President M. H. Moffett and F. R. Du Guay.

Minnesota Electric Association Meeting.—The tenth annual convention of the association will be held at the Hotel St. Paul, St. Paul, on March 20-22, 1917. The program includes papers on the following subjects: "Electric Cooking"; "Construction, Operation and Maintenance of Distribution Systems"; "Principles of Rate Making"; "Twenty-four-Hour Service in Cities of 1500 Inhabitants and Less"; "The Effect of Load Factor on Operating Costs," and "Profitable Customers." In addition to this there will be a paper on "New Forms of Illumination," which will be illustrated by photographs and models. On the last day there will be an experience meeting, where everybody will be expected to tell about his troubles and success—with the hopes that by a general discussion some solution may be reached of benefit to the member. Fred A. Otto, St. Paul, has been elected secretary of the association to serve during the remainder of the fiscal year.

Dayton Jovians to Give Banquet.—A banquet and cabaret will be held at the Miami Hotel, Dayton, Ohio, under the auspices of the local league on March 14. During the morning and afternoon of this day the new-business co-operation committee of the Ohio Electric Light Association will hold a convention at Dayton, the program for which is in another column. The banquet program follows: Chairman, Charles S. Hall, president the Dayton Jovian League, Dayton, Ohio; toastmaster, D. L. Gaskill, president the Greenville (Ohio) Electric Light & Power Company; speakers—Hon. James M. Cox, governor of Ohio, on "Present-Day Conditions"; H. M. Waite, city manager of Dayton, on "City Manager Form of Government"; J. E. North, chairman committee on new-business co-operation, Ohio Electric Light Association, on "The New-Business Committee of the Ohio Electric Light Association"; W. W. Freeman, president Union Gas & Electric Company, Cincinnati, Ohio, on "Relation of the Public Utilities to the Public"; C. F. Kettering, vice-president the Domestic Engineering Company, Dayton, Ohio, on "Future Applications of Electricity"; F. R. Coates, president the Toledo (Ohio) Railway & Light Company, on "The Public Be Pleased"; Judge R. W. Baggott, the Court of Domestic Relations, on "Selling Juice." The banquet will conclude with music and a "cabaret."

GEORGE B. TRIPP

George B. Tripp has resigned as vice-president of the United Gas & Electric Engineering Corporation of New York and on March 1 assumed his new duties as president of the Central Construction Corporation of Harrisburg, Pa. Mr. Tripp, who is president of the Pennsylvania Electric Association, has been connected with central station and utility company operation for many years. In 1911 he resigned as general manager of the Colorado Springs Electric Company to take up the management of the Harrisburg (Pa.) Light & Power Company, of which he was later made vice-president. More recently he was vice-president and operating executive of the United Gas & Electric Company, which operates the Harrisburg company, as well as a number of other utilities in various sections of the country. He will still retain his utility connection as vice-president of the Harrisburg Light & Power Company. The Central Construction Corporation of Harrisburg designs and constructs buildings, manufacturing plants, power plants, railroad terminals and engages in construction projects generally.

D. H. Braymer, who for the past two years has been engineering editor of the ELECTRICAL WORLD, has resigned to assume the editorship of the *Electrical Record.* Mr. Braymer succeeds George A. Wardlaw, who will engage in free lance literary work. Prior to his connection with the ELECTRICAL WORLD, Mr. Braymer was editor of *Electrical Engineering* of Atlanta, Ga., and of its predecessor, the *Southern Electrician.* He is a graduate of Cornell University with the degrees of A.B. and E.E., and spent some years with the Electrical Testing Laboratories and the Western Electric Company in New York City before engaging in editorial work. Mr. Braymer takes with him the best wishes of the publishing company from which he now severs his connections.

Dwight D. Miller has joined the staff of The Society for Electrical Development, to study and develop uses of electricity in the various industries, the work of the Society having grown to a point where it has become necessary to add another engineer to its staff engaged in this field. Mr. Miller is a graduate of Harvard University. He was for over ten years with the Westinghouse Electric & Manufacturing Company as sales engineer, and has been sales manager and consulting engineer for two other firms handling electrical and mechanical apparatus. Mr. Miller has also been a contributor to the technical press.

Men of the Industry

Changes in Personnel and Position—
Biographical Notes

Lewis A. McArthur, who has been appointed general manager of the Pacific Power & Light Company of Portland, Ore., to succeed J. E. Davidson, who resigned to take a position with the Electric Bond & Share Company of New York, has been with the Pacific company since its organization in March, 1910. He is a native Oregonian, and previous to attending the University of California, he was for two years a newspaper reporter. He graduated from college in 1908, and entered the employ of the Oregon Electric Railway Company as a ticket clerk. Later he was promoted to a position in the general offices of the railway company, and in March, 1910, when the Pacific Power & Light Company took over and consolidated a number of electric light, water and gas plants in Oregon, Washington and Idaho, he was made chief clerk to the president. In 1912 he was appointed assistant general manager of the company, and for a time had charge of the

LEWIS A. MC ARTHUR

company's properties at North Yakima, Wash. In addition to operating duties, Mr. McArthur has been editor of the company bulletin. Mr. McArthur has been active in society matters, and has been chairman of the program committee for the 1914 and for the 1917 annual conventions of the Northwest Electric Light & Power Association, and he was also chairman of the entertainment and program committee of the Portland Section of the N. E. L. A. during the year 1915-1916.

CHARLES J. MARSH

Charles J. Marsh, who since 1901 has been connected with the New York office of the Standard Underground Cable Company, has been elected a vice-president of that company. Prior to joining the forces of the cable company, Mr. Marsh was for twelve years connected with the United Electric Light & Power Company and the Brush Electric Illuminating Company of New York City, serving for a great part of the time as secretary and treasurer of both companies. He has been for many years manager of the Eastern and Northeastern sales department of the Standard Underground Cable Company and was also its principal Eastern metal buyer with headquarters in New York City. His many friends look upon his promotion as a well-earned reward for faithful and meritorious service. Mr. Marsh will continue to make his headquarters in New York and to exercise general supervision over the sales territory in which his genial character and ability have won him in his company so many friends. Mr. Marsh is vice-president of the New York Metal Exchange and a member of the Railroad Club of New York, the Montclair (N. J.) Athletic Club and the Commonwealth Club of Upper Montclair.

C. W. Jones has resigned as secretary of the Trumbull Electric Manufacturing Company of Plainville, Conn. Mr. Jones, who is well known throughout the electrical industry, had been connected with the Trumbull company for the last twelve years.

Dr. Morton G. Lloyd, formerly editor of the *Electrical Review* and *Western Electrician,* has accepted a temporary appointment as associate engineer in the Bureau of Standards at Washington.

B. G. Worth has been elected vice-president of Walter Kidde & Company, Inc., engineers and constructors, New York City, the new firm name of the business with which he has been associated for more than fifteen years as electrical engineer. In this capacity Mr. Worth has had charge of a large variety of power plant construction and factory electrification, and in later years also building construction, etc. He will hereafter be in general charge of the engineering and construction work of the company.

REVIEW OF TRADE AND MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

CONDITIONS IN ELECTRICAL SUPPLY JOBBING FIELD

Outlook Uniformly Good Throughout the Country—Demand Noticed for Conduit, Wire and Cable and Other Building Materials

Conditions in the electrical supply jobbing field are excellent and the outlook bright, according to the reports received by the ELECTRICAL WORLD. Slightly higher prices are anticipated in copper and iron products. Stocks generally are large, although there is an unmistakable disposition on the part of certain jobbers to keep stocks down and unload wherever possible because of that ever-present fear of a break in the market. Jobbers for the most part are buying heavily, mostly because of the long time required for goods to reach them. Dealers and contractors, however, are buying in large measure from hand to mouth.

Both credits and collections are uniformly good.

The consolidated reports from the different sections of the country follow:

NEW ENGLAND

A slight falling off in the volume of business is noted by representative jobbers in New England in comparison with the 1916 rate from Jan. 1 to March 1. The question of securing satisfactory deliveries is more troublesome than two months ago, the congestion of traffic on the railroads retarding shipments, in some cases seriously. Anticipating further difficulties along this line, stocks of conduit and wire are in some instances being increased beyond the previous normal. Collections and credits are very good according to reports lately gathered in the field.

Shortage of materials due in part to the railroad situation is likely to lead to further general price advances within the next few weeks or when the present stocks are exhausted. No evidence is at hand respecting any noticeably large demand for particular lines of manufactured goods. Some jobbers feel that the present volume of business is likely to continue substantially unabated up to the first of the year 1918.

In well-informed circles, the opinion has lately been expressed that the industry would be benefited by closer adherence to price levels established on the basis of a mutual understanding among wholesale distributers. In general, prices have advanced about 5 per cent since December, 1916. In the electric heating field, the desirability of special heating rates among many central stations has been emphasized by a prominent jobber anxious to "do his bit" in popularizing electric ranges. With a few notable exceptions this class of equipment has been rather conservatively received in New England, and the opportunities for development appear attractive at this time.

MIDDLE ATLANTIC

It is generally anticipated that prices will advance although there is a feeling that a declaration of war on the part of this country might cause a slump.

Stocks are uniformly large owing to the difficulty in obtaining satisfactory deliveries, and so long as the indications are toward higher prices large stocks will probably be maintained. Buying therefore, will be heavy on the advancing market.

Jobbers sales are heavy but show a tendency on the part of customers to buy more from hand to mouth, fearing a price reaction. Throughout the region there has been a marked demand for conduit, insulated wire and other building materials. Credits and collections are good.

The outlook is especially good just at present. From all indications 1917 will be a large year. Factory and industrial building activity continues, if anything, at a greater rate than last year. Apartment house, hotel, office building and dwelling house construction, however, does not present as bright a prospect. The high prices of building materials have undoubtedly retarded developments in these fields.

There is unmistakable evidence in this region on the part of some jobbers to unload some of their stock because of an impression that the upper limit has been reached and that a break in prices will accompany any statement of war activity from the White House.

SOUTH

Throughout the Southern states slight advances in prices of electrical supplies are anticipated. Some jobbers have large stocks, although for the most part they are normal with shortages in some lines.

It is not believed that buying will be heavy for a few months at least because of this fear of a break. In the Gulf States there seems to be a noticeable demand for conduit, conduit fittings, insulated wire and cable. Inland there is a rather unusual demand for independent telephone line material and an accelerated demand for farm lighting sets.

Credits and collections are reported as in good condition.

The general impression is that the outlook is good although it is doubtful if it would take much to change this view. The South is to such an extent an agricultural region of a peculiar nature that the people are hesitating to take any very definite steps and to buy for much more than immediate needs until they have some rather definite idea of the international policy to be followed by this country in the next few months.

CENTRAL AND NORTH MIDDLE WEST

In the Central and North Middle Western states jobbers' prices have been more staple in the last month than in previous months. Also, they have been well maintained. Such price changes as have been made were advances. Iron pipe and copper wire were the principal commodities to increase.

The condition of stocks now carried by different jobbers varies. The stocks of some are low; those of others fairly full. The impression seems to prevail that manufacturers' deliveries are getting in a little better shape and that jobbers' stocks will be more complete as the month progresses. The one commodity that is harder to get than any other now seems to be lamps. Embargoes are a factor in this situation. Motors are also scarce in some jobbers' stocks. The stocks of the customers of jobbers in general are believed to be low. It seems that the electrical contractors and dealers are perhaps as well stocked in the important staple lines as any of the buyers.

Nevertheless, heavy buying is universally expected in March. Construction work, efforts to accelerate industrial plant production, and the spring spirit that moves buyers, are looked upon as the factors that will influence this unusual demand. No one commodity or product has stood out conspicuously as moving faster than the majority of the stock in the last month and none is expected to in March. Credits and collections everywhere are reported good.

SOUTHERN PACIFIC

While there are some fluctuations, as a general thing the prices are more stable than last month. Such changes as occurred are all upward.

The condition of stocks is a little better and the jobbers feel safer because deliveries are being made more promptly.

Buying will be on a very conservative basis, that is, orders will cover the bare requirements as closely as they can be estimated. It is anticipated that sooner or later there will be a considerable decline in prices and it is the feeling that

purchases should be such as will supply needs and no more. As far as possible orders will be limited strictly to regular stock. When the decline in prices comes, the Pacific Coast jobber who always has to carry, comparatively, a large stock, expects to suffer from the reduction between rates of purchase and resale. Jobbers expect this and are willing to carry the loss on standard lines but are guarding against being caught with other than regular stock on hand.

Industrial business is heavy, contracting business good, but quite likely the latter will not continue at the present rate.

Caution in extending credit is the watchword. In the event of war it is quite possible that industrial business would offset the cessation of the contracting trade, so that jobbers would still be busy, but this would involve a considerable loss if credits had been too liberal previous to the change. Collections have been considerably slower than in the previous months, although this is not an unusual condition in the first and second months after the holidays.

General conditions are healthy. The best business is being done in industrial lines.

NORTH PACIFIC

The large electrical supply houses in this field, as a whole, report prices still on the upward trend, although the increase during the past month was not as noticeable as during the preceding months.

An effort is being made to keep plenty of stock on hand, but considerable difficulty, due to car shortage and the embargo, is experienced. This condition of affairs is expected to continue indefinitely and the various concerns are making their preparations accordingly. If the car-shortage bugaboo was not staring the various buyers in the face, the buying would be normal. Naturally, at this season of the year, buying is heavier as preparations are made for the spring building activities. But, due to prevailing conditions and circumstances, ordering is considerably heavier in order that early Spring and Summer delivery can be obtained.

While the above statements are literally true, other factors contribute to the active ordering mentioned. The Pacific Northwest, and particularly the Puget Sound section, is experiencing an active construction era, this being particularly true as regards shipbuilding. Building construction, too, considering the season of the year, is above normal.

Collections, compared with preceding months of this year, are good.

ELECTRICAL EXPORTS FOR 1916 PASS $40,000,000 MARK

December, the Largest Month in the Year, Closes a Record Twelve Months with a Total of $4,746,837

Surpassing all previous totals by wide margins, the total exports of electrical merchandise of American manufacture during 1916 amounted to $40,241,640. This exceeds the record year of 1913 by more than $12,000,000, or 43 per cent. The increase over 1915 was roughly $16,000,000 or 65 per cent. In comparison with 1914, the increase was more than 100 per cent.

Approximately half of the 1916 exports was in miscellaneous electrical goods. The value of this item in 1916 was $19,740,151, in comparison with $10,316,528 in 1915 and $8,509,468 in 1914. The value of the exports for almost every item was greater in 1916 than in the previous two years. Fans, however, were exported less in 1916 than in 1915, as were arc lamps and carbon filament lamps. Noticeable gains are found in the export of batteries, insulated wire and cable, metal filament lamps, motors, telephones. The exports of generators were slightly larger in 1916 than in 1915. Up to December, however, the export of generators had been running behind those of the previous year.

December brought this record year to a close with the largest monthly exports not only in the year but in the history of electrical shipping. The exports for the month in electrical goods totaled $4,746,837. This is in comparison with $2,177,338 for December, 1915. The gain, therefore, was considerably more than 100 per cent. In December, the exports of generators, meters, motors, and miscellaneous merchandise were the largest of any month in the year.

In using these figures for comparative purposes, too much emphasis cannot be laid on the fact that here values are given only, and not quantities. It must be remembered that the prices of electrical goods in 1916 were considerably in excess of those in 1915 and previous years. While it is undoubtedly true that much of the goods delivered in 1916 was placed at prices that were in effect before the increases took place, still a considerable quantity was shipped at very high prices. It is not doubted that the volume of exports in 1916 was greater than in previous years, owing principally to the fact that German and Austrian goods were shut out of the world market. It is no less true, however, that the excess of 1916 exports over 1915 exports is considerably less than indicated by values. In some items where an increase is shown by the values, it is quite probable that, as a matter of fact, the 1916 exports were less in volume of goods than in 1915, as, for instance, generators and interior wiring supplies. In some of the others it is doubtful how much of the apparent increase is actual.

The accompanying table shows the figures sent out by the Bureau of Foreign and Domestic Commerce, classified according to articles.

Articles	December		Calendar Year		
	1915	1916	1914	1915	1916
Batteries	$110,164	$212,457	$635,522	$1,364,999	$2,025,250
Generators	116,383	305,759	2,372,816	1,872,191	1,876,565
Fans	20,308	23,422	295,966	374,649	313,771
Insulated wire and cables	174,886	630,732	1,321,451	2,761,609	4,943,577
Interior wiring supplies, etc., including fixtures	76,967	110,750	591,136	882,891	901,657
Arc lamps	3,392	1,146	42,782	23,983	15,467
Carbon filament lamps	23,945	16,297	88,025	158,815	129,523
Metal filament lamps	120,998	128,394	278,061	865,188	1,415,562
Meters and other measuring instruments	68,463	102,832	157,386	657,129	884,241
Motors	233,250	526,952	3,300,839	3,278,413	4,930,396
Telegraph instruments (including wireless apparatus)	14,201	15,654	93,563	136,890	209,343
Telephones	87,722	301,107	1,251,788	910,623	1,813,969
Transformers	50,477	86,370	934,312	737,680	1,051,168
All other	1,076,182	2,284,965	8,599,468	10,316,528	19,740,151
Total	$2,177,338	$4,746,837	$19,963,115	$24,341,588	$40,241,640

COPPER MARKET QUIET

Prices Nominal, with Little Evidence of Buying Activity

Last week and early this week the copper market was very quiet. Prices are still high and nominal. There were but few purchasing orders. What orders there were stipulated mostly second quarter delivery.

Nominal prices for electrolytic were quoted on Tuesday as follows: February delivery, 36.5 cents; March delivery, 36.25 cents; second quarter, 34.5 cents; third quarter, 31.5 cents; fourth quarter, 30.25 cents.

NEW YORK METAL MARKET PRICES

	Feb. 19 Selling Prices Bid	Feb. 19 Selling Prices Asked	Feb. 26 Selling Prices Bid	Feb. 26 Selling Prices Asked
Copper	£ s d		£ s d	
London, standard spot	140 0 0†		139 0 0	
Prime Lake	35.00 to 35.50†		35.00	to 36.00†
Electrolytic	36.00 to 36.50†		36.00	to 37.00†
Casting	32.50 to 33.50†		33.00	to 34.00†
Copper wire base	41.50 to 42.50†		42.50	to 43.50†
Lead	8.50		8.50	
Nickel	50.00		50.00	
Sheet zinc, f.o.b. smelter	21.00		21.00	
Spelter, spot	10.55 to 10.67½		10.67½ to 10.92½	
Tin, straits	49.00†		49.87½†	
Aluminum, 98 to 99 per cent.	51.00 to 53.00†		51.00	to 53.00†
OLD METALS				
Heavy copper and wire	26.00 to 27.00†		27.50	to 28.00†
Brass, heavy	16.00 to 17.00†		17.50	to 18.00†
Brass, light	13.00 to 13.50†		13.75	to 14.00†
Lead, heavy	7.50 to 7.75†		8.00	to 8.50†
Zinc, scrap	7.50 to 7.75†		8.00	to 8.25†

COPPER EXPORTS

Total tons to 24,446

†Nominal.

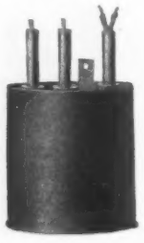
NEW APPARATUS AND APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Transformers for Series Lamps on Poles

Transformers have recently been developed by the Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa., which it is claimed render a series direct lighting system of distribution safe, and prevent broken lamp filaments from opening the series circuit and putting a branch of the system out of service. By the use of these transformers in the bases of ornamental poles, low-tension wiring may be employed in the poles, thus making the system safe and less expensive to install.

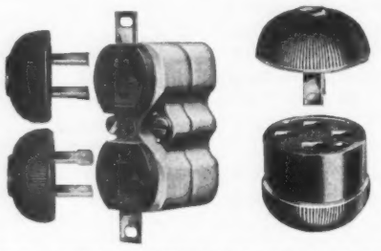
These safety transformers, which are given the trade name "Luxsolite," have two windings not inter-connected and therefore the lamps can be renewed without danger to the operator while the circuit is alive. They are of the core type construction with a case of heavy sheet steel. For manhole service heavy tinned pipe outlets are provided on which a joint with the lead-covered cable may be wiped. Small feet are provided for supporting the transformer in the bottom of the pole base. For overhead service, the leads are brought out through the bottom in porcelain bushings, and a strap is provided on the side for mounting on the pole. Before shipping, an insulation test of 20,000 volts is applied between the primary and secondary windings of each transformer.



TRANSFORMERS THAT ENABLE LOW TENSION WIRING TO BE USED ON LIGHTING POLES

Standard Plugs and Receptacles

Six electrical manufacturers have agreed on making standard plugs and receptacles, the attaching caps of which can be connected to the bodies of any of the several makes. In the accompanying illustrations are shown the C-H No. 7711 standard single flush receptacle, C-H No. 7721 duplex flush receptacle and C-H No. 7717 surface receptacle, all recently brought out by the Cutler-Hammer Manufacturing Company of Milwaukee. The single and duplex flush receptacles are made of white glazed porcelain and rated at 660 watts, 250 volts. The portions of the receptacles exposed through the apertures in the flush plates are enameled black, making a surface which does not show soil.

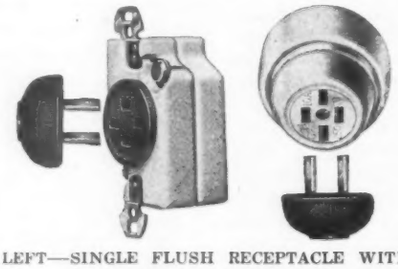


LEFT—DUPLEX RECEPTACLE WITH STANDARD ATTACHING CAP AND POLARITY CAP BELOW

RIGHT—SEPARABLE MOTOR ATTACHMENT PLUG AND CAP WITH STANDARD PARALLEL BLADES

Each outlet is provided with four slots with protected contacts—two parallel to receive the blades of the standard parallel blade cap or polarity cap—and two in tandem to receive the blades of the tandem-blade cap. The duplex receptacle is the same size as the single receptacle but has double the number of outlets, thus allowing the attachment of two electrical appliances from one outlet box. Large terminal screws are provided, one pair taking care of both receptacles. Grooves in the side of the porcelain body accommodate the conductors and prevent crowding in the outlet box.

The surface receptacle like the flush receptacles is of glazed porcelain with concealed contacts and slots arranged to accommodate standard attaching caps. It is designed for concealed wiring and has the same rating as the other receptacles.



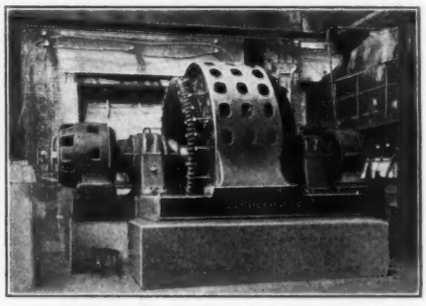
LEFT—SINGLE FLUSH RECEPTACLE WITH STANDARD ATTACHING CAP

RIGHT—SURFACE RECEPTACLE AND STANDARD ATTACHING CAP

A polarity cap with parallel blades, one enlarged to fit a correspondingly enlarged slot of the standard plugs and receptacles, has also been recently placed on the market by this company.

Power Factor Correction and Voltage Regulation Equipment

A large amount of single-phase power is purchased by the Pennsylvania Railroad Company for its twenty-mile Paoli electrification. This imposes unusual operating conditions on the generating station of the Philadelphia Electric Company, from which the power is obtained. Balanced load and high power factor were, therefore, highly desirable features, while in the case of the Pennsylvania Railroad Company voltage regulation was the prime essential. As the equipment in the generating station only took care of balancing the load, additional equipment was necessary to secure power factor correction and voltage regulation. Two 4500-kva., single-phase, 25-cycle, 11,000-volt, 500-r.p.m.



POWER FACTOR CORRECTION AND VOLTAGE REGULATING EQUIPMENT IN RADNOR SUBSTATION

Westinghouse synchronous condensers were therefore installed in the Radnor substation of the Railroad Company, each of which was provided with a 125-volt, direct-connected exciter, a single-phase, 330-volt, alternating-current starting motor, starting transformers, switching equipment, and complete Westinghouse voltage regulating equipment. The substation chosen was at practically the central point of the load. In addition to the continuous rating of 4500 kva., the condensers are guaranteed to carry 6000 kva. for one hour, and 9000 kva. for five minutes, to take care of the widely fluctuating load characteristics of single-phase railroad service, the latter rating being equivalent to 15,500 kva. on a three-phase circuit. As the condensers are used on single-phase circuits the usual alternating-current self-starting method could not be employed, and since the only power available was single-phase, an alternating-current motor of the series type, with suitable step-down transformers, was installed for each condenser. A liberal number of taps on the starting transformer assures

proper starting motor voltage over a relatively broad range of trolley voltage.

The stator winding of the condensers is of the usual three-phase, star-connected type, two legs only being used, and to eliminate vibration due to the widely fluctuating single-phase load, the mechanical parts of the machines are made extra heavy. The condensers are connected through suitable switching equipment, direct to the 11,000-volt trolley and ground. While the power factor of this kind of service is necessarily a varying quantity, due to the fluctuating load and variations due to changes in train locations, in general the resulting power factor with the maximum corrective effect of the condensers will be near unity, being raised to this value from approximately 65 to 70 per cent.

By means of Westinghouse voltage regulators of the broad range type, 11,500 volts is maintained on the trolley at Radnor at no load, gradually dropping off with increases in load to 11,000 volts at maximum overload. Two regulators are installed, each large enough to take care of one or both condensers, the source of direct current required being a small generator mounted on the outer bearing bracket of the starting motors. Each regulator, in addition to performing its function of voltage regulation, will, in conjunction with temperature relays and coils located in the armature winding of the condensers, serve automatically to reduce the load on the condenser in the event a certain pre-determined temperature is exceeded, thus preventing dangerous overloading of the machines.

Silvered-Glass Bowl-Shaped Reflector

The bowl-shaped reflector shown in the accompanying illustration has been designed by the National X-Ray Reflector Company of Chicago, Ill., for use with 75-watt Mazda "C" lamps. This reflector completes the line of one-piece silvered-glass reflectors for industrial and commercial lighting that this company has been making. It is designed in such a way, however, that it can be used with the 60-watt and 75-watt Mazda "B" lamps as well, and for general illumination or for localized light from drop lamps.

REFLECTOR FOR 75-WATT MAZDA "C" LAMPS

Other reflectors have already been developed by this company for lamps up to and including the 1000 watt. The entire line is of a deep-bowl type that practically conceals the lamp from view, and spreads the light flux considerably. The reflector shown herewith is known as No. 535.

Combined Electric Table Lamp and Phonograph

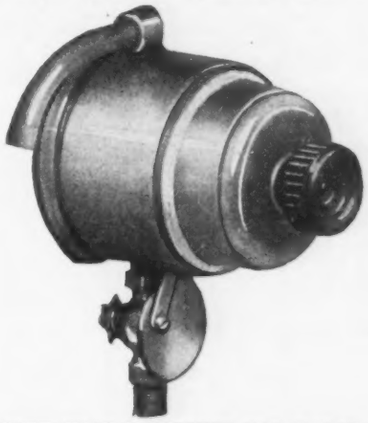
The combination phonograph and electric lamp shown in the accompanying illustration has been developed by the George C. Lynch Company of New York, N. Y. The phonograph is concealed in the base of the lamp, which is so designed that it will accommodate any size records up to the 12-in. disk. When the phonograph is to be played the hood is raised, the disk inserted and the power turned on.

The disk is revolved by a small motor in the same circuit as the electric light, but controlled by a separate switch. This arrangement makes it possible to play the instrument when the lamp is not in use. Instead of using a horn as with some "talking" machines, the sound is diffused through the stem of the lamp, which, it is claimed, considerably softens the tone. The "phonolite," as this combination set is called, is especially applicable where there is a limited amount of room as in small apartments.

PORTABLE LAMP WITH MOTOR-OPERATED PHONOGRAPH CONCEALED IN BASE

Light-Weight Thermo Electric Faucet

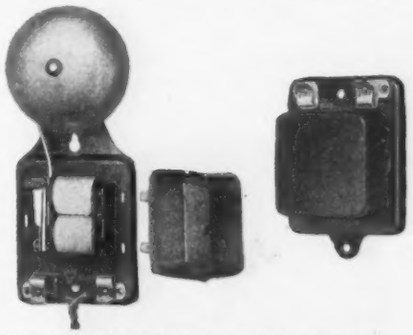
A water heater that can be easily attached to any plumbing, that takes its energy from the most convenient lamp socket, and that is easily operated, is shown in the accompanying illustration. The apparatus is the product of the Thermo Electric Faucet Company, 74 New Montgomery Street, San Francisco, Cal. The heating element is always submerged so that it cannot be exposed to a higher temperature than that of boiling water, and is automatically energized by the same motion that turns on the water. Since cold water may be drawn from the faucet without heating, it is not necessary to have a faucet especially for cold water. The heater, it is claimed, supplies hot water in three seconds, furnishing from 1 pt. to 1 qt. a minute depending upon the temperature required and thus may be used for any purpose except bath or laundry service. Weighing only a little more than 1 lb., the heater can be carried by travelers and tourists.



FAUCET THAT FURNISHES HOT WATER IN THREE SECONDS

Iron-Box Bells with Clip Connectors

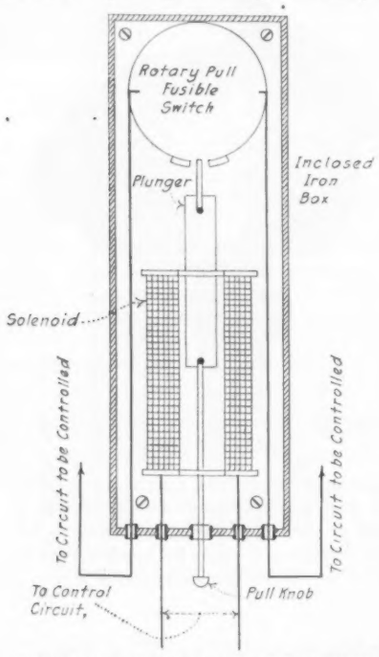
Iron-box bells and buzzers, manufactured by Edwards & Company, Inc., 140th and Exterior Streets, New York City, are now being furnished with Fahnestock clip connectors. They are made in three classes: One equipped with a locking adjustment screw for regulating the separation of the contacts; another does not have this adjustment, and a third is the same as the second except that the resistance is 5 ohms instead of 3. The gongs on these bells are riveted to the support to prevent removal or turning. The hammer rod, ball and armature are made in one piece. It is claimed that there is no space in which foreign matter will collect and interfere with operation because the armature pivot is near the point where the hammer rod passes through the cover, thus there is practically no motion allowing the opening in the cover to be almost the same size as the diameter of the hammer rod.



IRON-BOX BELLS AND BUZZERS EQUIPPED WITH CLIP CONNECTORS

Small-Capacity Remote-Control Switch

A small-capacity remote-control switch, which may be used to operate one or more lamps, motors, or other devices, requiring 10 amp. or less, is



DETAILS OF REMOTE-CONTROL SWITCH

being manufactured by the Gardner Electric Manufacturing Company of Bay Point, Cal. These switches can be operated by hand, as well as magnetically, from a push button. The mechanism is inclosed in a weatherproof sheet-iron box, which may be quickly attached to any support. By the use of this switch, it is claimed, electrical apparatus may be controlled at a distance without a heavy cost for conductors and the copper loss in them. The Gardner company is also making a switch similar to the one illustrated, that has a knife switch in place of the ratchet-pull switch.

Motor-Driven Propeller Fans

Propeller fans equipped with interchangeable round-frame motors are being manufactured by the Batterman Truitt Company of Chicago. The fans have an outer retaining ring, to which

PROPELLER FANS EQUIPPED WITH INTERCHANGEABLE ROUND-FRAME MOTORS

is attached three forged steel arms supporting the motor ring. The motor is mounted within the motor ring and is held rigid by three cap screws. The wheel consists of a bored and reamed hub with steel spokes securely riveted thereto. The outer rim is oxy-acetylene welded and riveted to the blades and spokes. The motor bearings, which are made of cast bronze alloy, have large wearing surfaces, and are self-aligning and interchangeable. Speed regulators are furnished with all direct-current fans 18 in. in diameter and larger, giving approximately 50 per cent speed reduction below normal by intermediate steps. These fans are equipped with Peerless motors.

Development of the Induction Relay

The placing of the selective protection of electric circuits upon a present scientific basis has been due largely to the efforts of F. E. Ricketts of the Consolidated Gas, Electric Light & Power Company of Baltimore, one of the earliest practical investigators of the subject of continuity of service. In pursuing his investigations Mr. Ricketts found that mechanically operated time

FIG. 1—TORQUE COMPENSATOR TYPE

elements such as bellows, would not answer requirements. Appreciating, however, the inherent advantages and accuracy of magnetically damped induction relays, he used them as a basis in perfecting a relay equipment suitable for carrying out his theoretically determined features of continuity of service. In the course of his search Mr. Ricketts found that the essential features necessary in the satisfactory operation of relays were accuracy of time-limit element and definite-minimum time-limit at any predetermined overload. The first was inherent to the induction relay; the second he obtained by the use of a saturating reactance coil, now known as a torque compensator, connected with the relay windings.

The first induction type of relay, according to the Westinghouse Electric & Manufacturing Company, was placed on the market in 1902. The induction principle of the operation was the same as had been used with great success in this company's alternating-current integrating watt-meters (now watt-hour meters) for several years prior to this time. This earliest relay was made in two forms, one form being illustrated in Fig. 2, and even in its early design, it is claimed, was superior in accuracy, reliability and sensitivity, to relays operating on other principles. One form was inclosed in a round case, while the other was of open construction designed for mounting on a panel board.

The torque compensator was first placed on the market in 1913 by the

FIG. 2—EARLIEST INDUCTION-TYPE RELAY

same company, as a separate device to be used in connection with the induction relay.

Since its introduction the development of the induction type of relay has advanced continuously. It has had various forms and has finally culminated in the overload and the reverse-power relay, the torque compensator being included self-contained, as a part of the relay. The reverse-power relay is shown in Fig. 3.

The adding of the torque compensator to the relay, and other perfections made at the same time, marked a distinctive advance in relay art, and has established the use of protective relays as one of the vital necessities in the continuity of service.

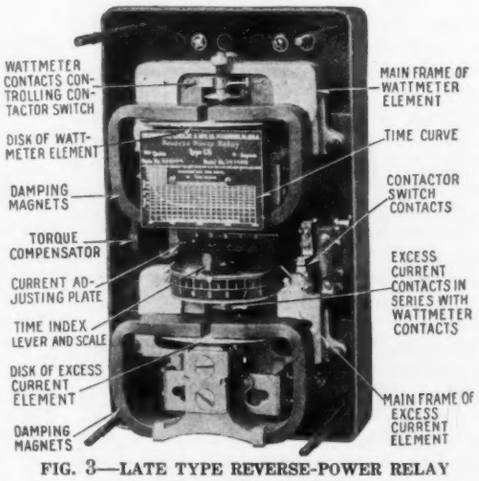

WATTMETER CONTACTS CONTROLLING CONTACTOR SWITCH
DISK OF WATTMETER ELEMENT
DAMPING MAGNETS
TORQUE COMPENSATOR
CURRENT ADJUSTING PLATE
TIME INDEX LEVER AND SCALE
DISK OF EXCESS CURRENT ELEMENT
DAMPING MAGNETS
MAIN FRAME OF WATTMETER ELEMENT
TIME CURVE
CONTACTOR SWITCH CONTACTS
EXCESS CURRENT CONTACTS IN SERIES WITH WATTMETER CONTACTS
MAIN FRAME OF EXCESS CURRENT ELEMENT

FIG. 3—LATE TYPE REVERSE-POWER RELAY WITH COVER REMOVED

Trade Notes

CAPT. RICHARD S. SATTERLEE, vice-president of the Habirshaw Electric Cable Company, Inc., died on Feb. 15.

F. LLOYD MARK has been appointed Western sales manager of the Central and near Western States for the Stroh Steel-Hardening Process Company. His offices are at 722 Monadnock Block, Chicago.

UTILITIES INDEMNITY EXCHANGE, Railway Exchange Building, St. Louis, Mo., has changed its name to the Utilities Indemnity and Fire Exchanges.

R. H. STARR has severed his connections with the engineering staff of the Toronto Hydro-Electric System, and has accepted a position as sales engineer with the sales office of the Moloney Electric Company of Canada, Ltd., Toronto.

P. H. AFFOLTER AND A. E. GARLAND, who were formerly connected with Fairbanks, Morse & Company, will in the future represent the Moloney Electric Company on the Pacific Coast. The office from which this business will be handled is located in the Rialto Building, San Francisco, Cal.

THE W. S. BARSTOW MANAGEMENT ASSOCIATION, 50 Pine Street, New York City, which will supervise the management of all public utility properties controlled by The General Gas & Electric Company, The Eastern Power & Light Comporation and W. S. Barstown & Co., Inc., has been incorporated. E. L. West has been elected president of the new corporation.

THE EDISON LAMP WORKS OF THE GENERAL ELECTRIC COMPANY, Harrison, N. J., is building a four-story brick and reinforced concrete addition, 135 x 190 ft., to its plant on Fifth Street, to cost about $300,000. An addition to the company's plant at Ampere, three-story, 90 x 150 ft., will also be erected; the cost is estimated at $100,000.

ELECTRIC MACHINERY COMPANY, Minneapolis, Minn., has opened new offices in Boston and New York. The Boston office is in charge of A. B. Boynton, whose address is 161 Devonshire Street. The Boston office will have charge of the entire New England territory. The New York office, situated at 828 Singer Building, is in charge of S. R. Dresser. This office will look out for eastern New York and northern New Jersey.

A. H. ACKERMAN, formerly vice-president and general manager of the U. S. Light & Heat Corporation, and C. C. Bradford, formerly sales manager of the same company, announce the formation of the Bradford-Ackerman Corporation, with offices in the Forty-second Street Building, New York City, to represent manufacturers of electric apparatus, automobile and railway supplies for domestic and export trade.

THE WESTERN CONDUIT COMPANY, a subsidiary of the Youngstown Sheet & Tube Company, and manufacturer of "Buckeye" conduit and "Realflex" armored cable, has been dissolved. The parent company will carry on the manufacture of these two products direct. This will be done at the same plant and under the same organization as heretofore, the change causing no disturbance in either the manufacture or sales end of the proposition.

EXPORT TRADE DIRECTORY.—The fifth edition of the Export Trade Directory has been issued by the Johnston Export Publishing Company, 17 Battery Place, New York. The work was compiled under the supervision of B. Olney Hough, editor *American Exporter*. It contains 536 pages and costs $5. The present volume gives information of great value to every exporter. The material has been presented clearly and concisely, and the classified indexes and cross indexes will be found especially practical.

AN INDUSTRIAL EXPORT EXPOSITION AND CONFERENCE will be held from May 26 to June 2 in the plant of the Eastern States Exposition at Springfield, Mass., as the result of a feeling in the manufacturing centers of the eastern states and New England that something tangible should be done to fortify the industrial interests to meet conditions that will follow the close of the war in Europe. The growth of the export business of this country in the last two years has emphasized the need of taking steps to hold what has been gained when there shall again be competition, and the coming export exposition and conference will be a move in this direction, in the opinion of the large body of industrial leaders and commercial organizations that are promoting it. This is no less true of the domestic expansion.

THE MOLONEY ELECTRIC COMPANY OF ST. LOUIS has just completed another extension to its present plant. This addition is twice as large as the company's old factory. In addition to this the company has another factory at St. Louis which contains three times as much floor space as the old factory. The total floor space at present occupied by the company for the exclusive building of transformers amounts to 128,000 sq. ft. The several plant extensions made during the past year have been necessitated on account of the company's rapid extension in business. Its total monthly shipments at the present are approximately ten times what they were about a year ago. This increase includes both domestic and foreign business. In the latter field the company is making striking strides and is now shipping to nearly all of the countries in the world.

COMMERCIAL MAP OF SOUTH AMERICA. Rand, McNally & Co., 40 East Twenty-second Street, New York, have issued a new Commercial Map of South America. The map is 46 x 66 in., and is exceptionally well printed and arranged. All names are in Spanish except those in Brazil, which are in Portuguese, and those in the Guianas, which are according to the countries which govern them. Accompanying the map is a book containing a list of all cities and towns in South America, with latest census figures. The location of all towns shown on the map are indicated by cross reference index. The spellings in this index are those used in the Postal Service. The map and index will be found of value to all interested in South American trade. The price is $15.

New Incorporations

THE GILL GLASS COMPANY of Millbrook, N. Y., has been incorporated by J. F. Fitzharris, E. C. Wilson and F. D. Gill, East York and Thompson Streets, Philadelphia, Pa. The company proposes to manufacture glass, glassware, electric lighting appliances, tools, etc. The company will carry on business with $335,000.

THE SOUTHERN FEDERAL WIRELESS CORPORATION has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $7,000,000 for the purpose of constructing and maintaining towers for receiving wireless messages. The incorporators are: William J. Cullen, John F. Roach and Clarence E. Bahm, all of New York, N. Y.

THE McDANIEL & CAMPBELL ELECTRIC COMPANY of Springfield, Ohio, has been chartered with a capital stock of $25,000 by William McDaniel, Roy J. McDaniel, R. E. McDaniel of Springfield; Carl Campbell and Fred Campbell of Columbus, Ohio.

THE COOKSON-FORESMAN ELECTRIC COMPANY of Newton, Mass., has been incorporated with a capital stock of $10,000. The directors are: W. B. Cookson, president; Fred A. Foresman of Ashby, treasurer, and C. R. Metchear.

THE CAMPBELL ELECTRIC CORPORATION of Lynn, Mass., has been chartered with a capital stock of $5,000. The officers are: Lawrence E. Gott, of Swampscott, president; Fred R. Campbell, treasurer, and J. Schwartz, clerk, both of Lynn.

THE CHICAGO GLASS SPECIALTY WORKS of Chicago, Ill., has been organized with a capital stock of $25,000 by A. C. Laussen, Henry Dupke and F. B. Yamnicky. The company proposes to blow glass in all its branches by machinery.

THE STIEFVATER ELECTRIC COMPANY of Utica, N. Y., has been incorporated by C. W. Clare, A. C. and E. G. Stiefvater of Utica. The company is capitalized at $15,000 and proposes to do a general contracting and electrical business.

THE EXPERT DISPLAY LIGHTING CORPORATION of New York, N. Y., has been chartered with a capital stock of $5,000 to manufacture and deal in signs, devices, novelties, machinery for distributing electricity. The incorporators are: L. Friedman, H. C. Wiley and H. Harris, 31 Nassau Street, New York, N. Y.

THE AMPER LOCK & SWITCH CORPORATION of Buffalo, N. Y., has been incorpofated by W. H. Farnsworth, 937 Main Street: A. L. Higley, 920 Niagara Street, and W. H. H. Davenport, 219 Ellicott Square, Buffalo, N. Y. The company is capitalized at $100,000 and proposes to manufacture locks, switches, electrical machinery, etc.

Trade Publications

PNEUMATIC EJECTOR.—The Yeomans Brothers Company, 231 Institute Place, Chicago, Ill., is distributing bulletin No. P-4000, descriptive of the Shone system pneumatic ejectors for automatically raising sewage and drainage from basements below street sewer level, municipal sewerage systems, etc.

CLAY PRODUCTS.—The Laclede-Christy Clay Products Company of St. Louis, Mo., is distributing its January issue of the L-C bulletin, giving information regarding its clay products.

CALL SYSTEM.—The Autocall Company of Shelby, Ohio, has recently issued a well-illustrated bulletin descriptive of its autocall system. This is an electrically operated audible signaling service, the purpose of which is to promptly locate any of the heads or important members of an organization without disturbance to any but the party wanted.

LAMPS.—The Franklin Electric Manufacturing Company of Hartford, Conn., is distributing a leaflet entitled, "Disarm the Darkness." This folder is descriptive of the Franklin Mazda lamps.

TROLLHATTAN CANAL.—Two handsome books describing and giving the history of the Trollhattan Canal of Sweden have been received. These two volumes show care in preparation and are well illustrated.

AUTOMOBILE ACCESSORIES. — The Benjamin Electric Company has issued a twenty-four page catalog illustrating and describing such automobile accessories as horns, push buttons, dry-battery cases, lamp regulators, speedometer lamps, magneto magnetizers, garage lighting equipment and tools.

INSTRUMENTS. — Ampere-hour meters are described and illustrated in Bulletin No. 45 now being distributed by the Sangamo Electric Company of Springfield, Ill.

ELECTRICAL INSTRUMENTS. — The Harvard Electric Company, 525 West Van Buren Street, Chicago, Ill., manufacturers of ammeters, voltmeters, and battery indicators, have just issued a new catalog, No. 25, illustrating and describing its instruments.

LAMPS.—The Faries Manufacturing Company, Decatur, Ill., is distributing an illustrated leaflet of its Verdelite desk and piano lamps.

FANS.—The Robbins & Myers Company of Springfield, Ohio, has recently prepared Catalog No. 1106 descriptive of its electric fans for alternating and direct-current circuits.

HEATING PAD.—The Standard electric heating pad is illustrated and described in a leaflet now being distributed by the Standard Electrical Appliance Company of Beverly, N. J.

REFLECTORS.—Bulletin No. 15-22, descriptive of steel reflectors for industrial lighting, has just been issued by Harvey Hubbell, Inc., Bridgeport, Conn.

AIRCRAFT ENGINE.—The Packard Motor Car Company of Detroit, Mich., has prepared an illustrated bulletin descriptive of its aircraft engine.

GRINDERS.—The Van Dorn Electric Tool Company of Cleveland, Ohio, has issued an illustrated leaflet descriptive of its electric grinders.

TRUCKS.—The General Motors Truck Company of Pontiac, Mich., is distributing issue No. 15 on truck talks.

FANS.—The Knapp Electric & Novelty Company, 511 West Fifty-first Street, New York, N. Y., has prepared a leaflet descriptive of its fans for 110 volts and for battery service.

SEWING MACHINES.—The Western Electric Company, Inc., is distributing illustrated leaflet descriptive of its complete line of portable sewing machines. There are three types in this line, the vibrator type, the rotary type and the automatic type.

CONSTRUCTION ENGINEERS.—"The Puzzle of Prosperity and Its Solution" is the title of a carefully prepared and well-illustrated bulletin now being distributed by W. S. Barstow & Company, Inc., 50 Pine Street, New York, N. Y. The book contains photographs of some of the construction work accomplished by this engineering and construction company.

MOTOR GENERATORS.—Bulletin No. 1001 descriptive of self-operating generating units has been issued by the S. V. M. Sales Corporation, 1765 Broadway, New York, N. Y.

New England

BANGOR, ME.—The Bangor Railway & Electric Company is planning to erect an electric transmission line from the Ellsworth, Veazie and Milford stations to the plant of the Eastern Manufacturing Company at Lincoln, with whom it has contracted to supply 2000 hp. The cost of the line is estimated at about $75,000.

BIDDEFORD, ME.—Plans are being considered by the Clark Power Company of Dayton, a subsidiary of the Pepperell Manufacturing Company, for the construction of a hydroelectric power plant on the Saco River near Union Falls, to supply energy for the Pepperell and York Mills.

HOLYOKE, MASS.—After noting the need of many improvements at the municipal electric light plant, John J. Kirkpatrick, manager of the gas and electric department, recommends in his annual report the construction of an entirely new plant along the river front somewhere, rather than making the improvements suggested. Among the new machinery needed are a new scrubber, exhauster, condenser, two extractors and station meter. The electric plant needs additional coal storage capacity and new boilers.

NORTH DANA, MASS.—The power house of the North Dana Electric Light Company was recently destroyed by fire, causing a loss of about $2,000. The town is at present without electrical service.

PROVIDENCE, R. I.—Bids will be received at the office of the city clerk, City Hall, Providence, until March 12, for furnishing an 8,000,000-gal. pumping unit at the Mount Hope pumping station. Further information may be obtained at the office of the city engineer, City Hall. W. C. Pelkey is city clerk.

Middle Atlantic

BAINBRIDGE, N. Y.—The Public Service Commission has granted the Standard Light, Heat & Power Company of Unadilla permission to construct an electric plant and exercise a franchise in the town of Bainbridge.

BUFFALO, N. Y.—Preparations are being made by the Buffalo General Electric, Postal Telegraph, Western Union Telegraph and New York Telephone Companies to place their wires in underground conduits in accordance with city ordinances. An appropriation will be asked by Arthur W. Kreinheder, commissioner, for an appropriation to bury all police and fire department wires in conduits constructed by these companies.

HEMPSTEAD, N. Y.—The Nassau Light & Power Company of Mineola is negotiating with the village officials for a contract for lighting the streets of the village. Gas is now used.

NEW YORK, N. Y.—Bids will be received by Robert Adamson, fire commissioner, Eleventh Floor, Municipal Building, New York City, until March 9 for furnishing 1400 twin fire alarm posts. Bids will also be received at the same time and place for upper parts for 161 fire alarm posts. Blanks and further information may be obtained at the office of the Fire Department, Eleventh Floor, Municipal Building, upon deposit of $5.

NEW YORK, N. Y.—The Metropolitan By-Products Company, 52 Vanderbilt Avenue, New York City, has awarded the wiring contract for its plant at Lake Island, Staten Island, N. Y., to Louis Kalischer, 1225 Myrtle Avenue, Brooklyn. The plant will be equipped with 2200 hp. in motors and about 100 kw. in interior and flood lighting. This is a three-phase, 60-cycle, 440-volt installation.

NEW YORK, N. Y.—Bids will be received at the office of Robert Adamson, fire commissioner, eleventh floor, Municipal Building, New York City, until March 5 for furnishing and installing underground lead-covered cables and appurtenances for Rockaway Improvement, borough of Queens. Blank forms and further information may be obtained at the office of the Fire Department, upon deposit of $5.

NEW YORK, N. Y.—Bids will be received by the Board of Trustees of Bellevue and Allied Hospitals in the office of the general medical superintendent, Bellevue Hospital (entrance 415 East Twenty-sixth Street) until March 5 for furnishing and installing lighting fixtures for the outpatient department at Gouverneur Hospital, situated at Front Street and Gouverneur Slip, borough of Manhattan. Blank forms and further information may be obtained at the office of the chief clerk and auditor, 400 East Twenty-ninth Street, New York City.

RENSSELAER, N. Y.—A movement has been started by local business men for the installation of an ornamental lighting system on Broadway.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

TOMPKINSVILLE, N. Y.—Plans are being considered by the Richmond Light & Railroad Company, it is reported, for the erection of aerial cable line from Linoleumville to Lake Island, over Fresh Kill Creek, to supply light and power service.

WALDEN, N. Y.—The Public Service Commission has granted the Wallkill Valley Electric Light & Power Company franchises to operate in Montgomery and Crawford, Orange County.

ALTOONA, PA.—The Penn Central Light & Power Company contemplates the erection of an electric transmission line from Warriors Ridge to Lewistown, to cost about $150,000.

ALTOONA, PA.—The Penn Central Light & Power Company will duplicate its high-tension transmission line in Cambria County at a cost of about $56,000. The proposed line will be extended from the substation at Collinsville to Cresson and thence to Ashville.

ERIE, PA.—The construction of a new lighting and heating plant, at a cost of about $1,000,000, is under consideration by the Erie Lighting Company. Negotiations are under way for the purchase of a site for the proposed plant. Fred B. Hofft is vice-president and general manager.

PHILADELPHIA, PA.—Work has begun on the erection of the high-tension line, which will connect the power house at Twenty-sixth and Christian Streets with the plant of the Beacon Light Company, now under construction, in South Chester. The cost of the transmission line is estimated at $300,000. The entire development undertaken in Chester, including the connection with Philadelphia, will cost about $6,000,000.

SUMMIT HILL, PA.—The installation of a new fire alarm system is under consideration by the borough officials.

SWISSVALE, PA.—The plant of the Union Switch & Signal Company at Swissvale, recently destroyed by fire, will be rebuilt at once. The new plant and equipment will cost about $6,500,000. The loss by the fire was about $4,200,000.

GARFIELD, N. J.—Bids will be received by the Mayor and Borough Council of Garfield until March 9 for furnishing and installing pumping equipment as follows: (1) Two air compressors for air lift pumping system; (2) one 110-hp. horizontal tubular boiler; (3) one air receiver. Specifications, etc., may be obtained at the office of Anton L. Petterson, borough engineer, Post Office Building, Passaic, N. J.

JERSEY CITY, N. J.—The Public Service Electric Company has applied to the City Commission for a fifty-year franchise for an underground conduit system in Jackson Avenue.

JERSEY CITY, N. J.—The Ocean Avenue Business Men's Association is negotiating with the City Commission for the installation of a new street lighting system on Ocean Avenue, Greenville.

JERSEY CITY, N. J.—Plans, it is reported, are being perfected by the Erie Railroad Company for equipping its Greenwood Lake branch from Jersey City to North Newark and vicinity for electrical operation.

NEWARK, N. J.—The Board of Freeholders, it is reported, has authorized a call for bids, to be received on March 15, for four new boilers at Overbrook Hospital.

PERTH AMBOY, N. J.—Negotiations are under way between the Public Service Electric Company and the Board of Aldermen relative to franchise applications for the installation of underground conduits on several streets. The company proposes to place its overhead wires underground.

PRINCETON, N. J.—The Borough Council is considering the installation of additional new street lamps.

SEWELL, N. J.—The Township Committee has authorized the town clerk to obtain estimates of cost for the installation of an electric-lighting system for both street and residential lighting.

TRENTON, N. J.—The Chamber of Commerce will co-operate with the City Commission for the installation of the proposed ornamental lighting system in the business district and improvements in other sections.

WOODBURY, N. J.—The Borough Council is considering the installation of an electric street lighting system to replace the gas lamps now in use.

WILMINGTON, DEL.—The Street and Sewer Department is contemplating the installation of an improved street-lighting system on King Street.

MIDLAND, MD.—Rights of way have been secured for the erection of the new high-tension transmission line between Midland and Junction Park by the Midland Electric Light Company. A line is being built across the Ohio River a short distance above the Merrill dam to supply energy to the Beaver County Home buildings. The construction of a large substation near the eastern end of the borough is also under consideration.

ETTRICKS, VA.—The installation of an electric lighting system in Ettricks is under consideration.

FREDERICKSBURG, VA.—The Rappahannock Electric Light & Power Company will install this spring water tube boilers, engine and auxiliaries, bids for which will be asked in about 30 days. The Richmond, Fredericksburg & Potomac Railroad Company is now installing automatic signals (6600 volt, single phase); the Rappahannock electric company will supply energy to the Fredericksburg substation. S. C. Foster is general superintendent.

WINCHESTER, VA.—In a decision handed down by the Berkeley County Court in regard to the franchise for the Northern Virginia Power Company of Winchester, to erect and maintain electric transmission lines along various roads in Berkeley County, the company is given the privilege of building and operating lines in Berkeley County.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations supplies as follows: Washington, D. C., Schedule 769—200 altimeters; Schedule 770—one vertical milling machine. New London, Conn., Brooklyn, N. Y., Schedule 773—nine portable lead-burning outfits, 250 storage battery testing outfits. Brooklyn, N. Y., Mare Island, Cal., Schedule 765—two distilling plants. Mare Island, Cal., Schedule 767—four lubricating oil pumps; Schedule 766-767—12 air, condenser and feed pumps; Schedule 752—9725 lb. steel wire rope; Schedule 758—57,000 lb. class "C" angle steel, 137,500 lb. class "B" boiler plate steel. Brooklyn, N. Y., Schedule 749—one motor delivery wagon. Application for proposal blanks should designate the schedule desired by number.

North Central

CHEBOYGAN, MICH.—Plans have been prepared by Gardner S. Williams, 134 South LaSalle Street, Chicago, Ill., it is reported, for rebuilding the hydroelectric power plant owned by the Cheboygan Electric Light & Power Company.

GREENFIELD, MICH.—Bids will be received at the office of Leon W. Webster, secretary school district No. 1, Highland Park, P. O., Mich., until March 19 for addition to Greenfield Park School in Greenfield Township, separate bids to be submitted on general contract, electrical work, plumbing and heating. Copies of plans and specifications may be obtained at the office of Edward C. Van Leyen and Edward A. Schilling, H. J. Keough, architects, Union Trust Building, Detroit, upon deposit of $15.

MONROE, MICH.—At a special election to be held in March the proposal to issue bonds for the construction of a new plant or to grant a franchise to either the Detroit Edison Company or the Toledo (Ohio) Railway & Light Company to enter the city to supply electricity to private manufacturing plants will be submitted to the voters. The cost of a new plant is estimated at more than $100,000.

TEKONSHA, MICH.—The local electric plant, owned by the Warner Electric Light Company, has closed down, leaving the village without electrical service. The company offered to sell the plant to the village but the offer was refused. The plant was not self-supporting.

WHITEHALL, MICH.—The Frugale Power Company will erect an electric transmission line, 10 miles long in the spring, and also rebuild its dam at Hesperia, Mich., installing new wheels and generators. F. H. Speese is secretary and manager.

BELLEVILLE, OHIO.—The Guinsler Electric Light & Power Company of Junction City has recently been granted a new 35-year franchise in Belleville, and also a new street-lighting contract for ten years, effective as soon as the company installs a new circuit. W. E. Guinsler is manager.

BLOOMVILLE, OHIO.—The village of Bloomville has abandoned the project of establishing a municipal electric plant and will probably contract with a private company, probably the Ohio Light & Power Company, whose high-tension line passes through the town.

CINCINNATI, OHIO.—Bids will be received by the Commissioners of Hamilton County, Court House, Cincinnati, until Mar. 21, for construction, including heating, plumbing, ventilating apparatus, electric work, for new women's receiving cottage for Longview Hospital. The work includes erection of power plant in connection with building. Elzner and Anderson, Ingalls Building, Cincinnati, are architects.

CLEVELAND, OHIO.—Bids will be received at the office of commissioner of purchases and supplies, City Hall, Cleveland, until March 9 for laying cable under Cuyahoga River at Jefferson Street bridge. Specifications may be obtained upon application to the bridge engineer.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, City Hall, Cleveland, until March 9, for one 150-hp. gas engine-driven generating unit for the division of infirmary, Warrensville, Ohio, department of public welfare. Specifications may be obtained on application to the office of the secretary to the director of public welfare, 327 City Hall.

HAMILTON, OHIO.—Plans are being considered by city officials for extensions and improvements to the municipal electric light plant. The cost is estimated at $50,000.

LIMA, OHIO.—The contract for electric wiring for the illumination of the ten grade schools has been awarded to Reed Brothers of Lima. The work must be completed by May 15.

NEW LONDON, OHIO.—Bids will be received by the clerk of board of public affairs, New London, until March 12, for construction of water-works system, consisting of 5.7 miles of 8, 6, and 4-in. cast-iron pipe, together with necessary valves and hydrants, two high-service pumps and motors, concrete receiving well and a 50,000-gal. elevated tank and tower. Plans and specifications may be seen at the office of the Board of Public Affairs or may be obtained at the office of Philip Burgess, consulting engineer, Columbus, Ohio, upon deposit of $5.

NEWTON FALLS, OHIO.—The Village Board, it is reported, has awarded a contract for the installation of a new lighting system. Energy to operate the system will be purchased. The village has been without electrical service several months.

PIQUA, OHIO.—Specifications are being prepared under the supervision of Chief Coulfield of the fire department for the installation of a new fire-alarm system. A new police telephone system may be provided for at the same time.

TROY, OHIO.—Plans are being considered for merging the municipal electric-light plant and water-works system in connection with increasing the output of the power plant. A new location and complete reconstruction for both plants may be decided upon. The Richards Engineering Company of Columbus is consulting engineer.

YOUNGSTOWN, OHIO. — Preparations are being made by the Republic Iron & Steel Company for equipping its finishing departments for electrical operation, energy to be generated at Haselton, where large quantities of furnace gas are produced, which will be used for fuel to supply power to operate the generators.

CHAVIES, KY.—The Coneva Coal Corporation contemplates the installation of a steam-driven electric plant and would like to receive prices on a 125-kw. belt-driven generator, new or second hand. Lee Congleton is manager.

COVINGTON, KY.—The City Council has engaged G. Hornung, Woosack Building, Newport, engineer, to prepare plans for the proposed municipal electric-light plant.

EDMONTON, KY.—The installation of an electric-light plant in Edmonton is reported to be under consideration.

ELKTON, KY.—The local electric light plant has been purchased by the South Kentucky Power Company of Guthrie. A. F. Trimble of Guthrie is vice-president and general manager of the South Kentucky Power Company.

PADUCAH, KY.—H. T. Ward and F. L. Wilcox, electrical engineers of St. Louis, Mo., have advised Mayor Burns and the City Commissioners that the project to establish a municipal electric plant to supply electrical service throughout the entire city would probably call for a new installation. It was proposed to enlarge the present municipal electric plant, which furnishes the street-lighting service, to supply electricity for commercial and residential lighting. The commission, it is stated, will have surveys made and an estimate of cost of a plant with a view of issuing bonds for same.

WALTON, KY.—The local electric-light plant, owned by E. L. Kelly, was recently destroyed by fire, causing a loss of about $5,500.

NAPPANEE, IND.—The Hawks Electric Company of Goshen has submitted a proposal to the Board of Town Trustees for the purchase of the municipal electric-light plant. Plans have been prepared for equipping the plant, but some of the taxpayers are in favor of selling the property.

SHERIDAN, IND.—The Sheridan Water, Light & Heat Company has petitioned the Public Service Commission for authority to issue $10,000 in bonds, the proceeds to be used for extensions to its electrical plant and for ice storage facilities.

CHICAGO, ILL.—The removal of all overhead telephone, telegraph and electric wires has been recommended by a subcommittee of the City Council gas, oil and electric light committee. The cost of placing the wires underground is estimated at between $2,000,000 and $3,000,000. The cost to the Sanitary District is placed at $400,000 and to the city of Chicago at $300,000. The proposed measure exempts the trolley lines.

LENA, ILL.—The Lena Electric Light & Power Company expects to be in the market in the early spring for material to erect 16 miles of 33,000-volt, three-phase electric transmission line, two-pole type, substations, one 200-kva. generating unit complete, with switchboard for same; also distribution line for street-lighting system, consisting of about 95 series 6.6-amp. lamps. The company also contemplates reinsulation of 8 miles of single-phase, 6600-volt line to three-phase, 33,000-volt line. G. W. Benfer is manager.

SPRINGFIELD, ILL.—If the present plans of the City Council in regard to the Centennial Civil Improvement scheme are carried out additional expenditures of approximately $900,000 by the Springfield Gas & Electric Company and the Springfield Consolidated Railway Company will be necessary. The work will include ducts and manholes for underground wire system, to cost about $98,000; cables for underground system, $300,000; street railway company's share of paving, $89,069; railway construction work, labor, etc., $233,203; replacement and overhauling steam, hot water and gas mains on repaved streets, $100,000, and seven new "pay within" cars $40,000. A. D. Mackie is general manager.

ASHLAND, WIS.—The L. E. Meyer Company of Chicago, Ill., has assumed control of the holdings of the Appleyard interests in Wisconsin and Northern Michigan, which include the Ashland Street Railway Company, the Ashland Power Company and the Ironwood & Bessemer Railway & Light Company. The headquarters of the company will remain in Ashland.

BEAVER DAM, WIS.—The Wisconsin Telephone Company contemplates placing its local overhead wires in underground conduits, at a cost of about $25,000.

EVANSVILLE, WIS.—The city of Evansville has placed contract for 300 hp. in boilers, to be delivered May 1, for the municipal electric-light plant. E. S. Cary is superintendent.

FOND DU LAC, WIS.—The Kelsey-Brewer Company of Grand Rapids, Mich., is negotiating for the purchase of the properties of the Eastern Wisconsin Railway & Light Company of Fond du Lac and the Winnebago Traction Company of Oshkosh, which include the traction lines at Fond du Lac and Oshkosh, gas and electric properties in this city, the interurban lines and water power rights in Marathon and Langlade Counties. Improvements involving an expenditure of about $700,000 are contemplated, including the erection of a new gas plant in Fond du Lac in a new location and improvements to the local power plant. Joseph H. Brewer of Grand Rapids, Mich., is president and general manager of the Kelsey-Brewer Company.

MELLEN, WIS.—Within the next six months the Mellen Water & Light Company expects to purchase one or two horizontal water wheels, steel flume and harness, and a generator with a rating of about 150 kva. for direct connection, and also an engine of about 150 hp. A. W. Pribnow is president and manager.

OSHKOSH, WIS.—A committee has been appointed to consider the question of improving the electric-lighting system.

RIPON, WIS.—The Ripon Light & Water Company contemplates the erection of 100 miles of electric transmission lines from Portage to Beaver Dam and neighboring towns this spring.

UNION GROVE, WIS.—The power plant of the Union Grove Electric Light & Water Company was recently destroyed by an explosion, causing a loss of about $12,500. The plant, it is understood, will be rebuilt at once. William Hardy is proprietor.

WATERLOO, WIS.—The Council has appropriated $4,000 for extensions and improvements to the municipal electric-light plant.

WHITEWATER, WIS.—The City Council contemplates rebuilding its electrical distributing system at a cost of about $25,000. The present wire is too small to carry the load.

BENSON, MINN.—Plans are being prepared for remodeling the municipal electric lighting system from direct to alternating current. W. E. Skinner, 714 Plymouth Building, Minneapolis, is consulting engineer.

DEER RIVER, MINN.—The property of the Everton Electric Light & Power Company has been purchased by R. M. Dungan and H. E. Griswold of Eveleth. The new owners, it is understood, will make improvements to the plant and establish a 24-hour service. The installation of a central heating system is also under consideration.

RUTHTON, MINN.—The installation of a municipal electric-lighting system in Ruthton is under consideration.

CEDAR RAPIDS, IOWA.—The National Oats Company contemplates equipping its plant for electrical operation. Energy will be obtained from the Iowa Railway & Light Company.

SHEFFIELD, IOWA.—The property of the Sheffield Light & Power Company has been purchased by the Cedar Valley Electric Company of Charles City. Improvements, it is understood, will be made to the system.

CLARKTON, MO.—The local electric light plant has been purchased by Louis Dunn. The new owner, it is understood, will enlarge and improve the system.

HARRISONVILLE, MO.—The Board of Aldermen is considering a proposal submitted by L. K. Green & Sons to supply electricity in Harrisonville from their plant at Pleasant Hill.

KIRKSVILLE, MO.—Improvements are contemplated to the local electric-light plant, which is controlled by the North American Securities Company. Energy will be furnished to small towns between Kirksville and Bonneville that are now without electrical service.

PECULIAR, MO.—The L. K. Green & Sons Electric Company has applied to the City Council for a franchise to supply electricity in Peculiar.

POPLAR BLUFF, MO.—The City Council is reported to be considering a proposal to issue $10,000 in bonds for the installation of an electric-lighting system.

SPRINGFIELD, MO.—The Federal Light & Traction Company is reported to have purchased a site on which it proposes to erect a substation, to cost about $250,000, which will be used to relay the hydroelectric power now being supplied to the Springfield Gas & Electric Company from the power plant at White River dam. The present plans provide for the installation of a 5000-kw. turbine.

CENTERVILLE, S. D.—The Centerville Milling Company contemplates the installation of a large engine, an additional boiler, another water wheel and generator and building a concrete dam. R. W. Nash is superintendent.

ALEXANDRIA, S. D.—The Council is considering calling an election to submit to the voters the proposal to issue $18,000 in bonds for extensions to the municipal electric-light plant.

CRAWFORD, NEB.—The City Council has passed an ordinance providing for the installation of an ornamental lighting system in the business district.

HUTCHINSON, KAN.—The City Council is securing estimates on the cost of an ornamental street-lighting system with a view of installing new lamps in the Ninth addition.

LEAVENWORTH, KAN. — Preparations are being made for a survey of a pipe line for water supply from the Missouri River to the power plant of the Leavenworth Light, Heat & Power Company.

MEADE, KAN.—The Meade Light & Power Company is completing the installation of a new 50-kw. generating unit driven by an oil engine.

TOPEKA, KAN.—The Town Meeting Club on Feb. 7 adopted a platform for the coming city campaign favoring the rebuilding of the municipal electric-light plant at the waterworks station.

TOPEKA, KAN.—Changes in the street lighting system have been recommended by E. G. Stahl, superintendent of the municipal electric plant, which provide for replacing 100 arc lamps with 400-cp. incandescent lamps, installing alley lamps in the fire district, establishing a low voltage lighting system in the parks in place of the high-voltage arc lamps now in use and the purchase of new generating equipment.

WILSON, KAN.—The City Council is considering the installation of an additional generating unit, about 40 kva., in the near future. J. H. Williams is superintendent.

Southern States

BURLINGTON, N. C.—The Piedmont Railway & Electric Company has begun work on the extension of its transmission lines to Elon College and Gibsonville.

COLUMBUS, GA.—An election will be called to submit the proposal to issue bonds for the establishment of a municipal electric light plant to the voters.

GAINESVILLE, GA.—Plans are under way for removing all unnecessary duplication of lines and other equipment and remodeling the local distribution system by the Georgia Railway & Power Company. Electrical service was served by both the Georgia Railway & Power Company and the Gainesville Railway & Power Company until the latter was taken over by the former.

STATESBORO, GA.—Bonds to the amount of $60,000 have been voted for improvements to the electric-light plant and waterworks system and street paving.

UNADILLA, GA.—At an election held recently the proposal to install an electric-lighting system was carried.

ORLANDO, FLA.—The City Council is considering calling an election to vote on the proposal to issue $20,000 in bonds for a new street-lighting system, including ornamental lamps.

WETUMKA, ALA.—The Montgomery (Ala.) Light & Water Power Company is contemplating extending its service to Wetumka. Preparations, it is understood, are being made to equip the prison plants for electrical operation.

COLUMBUS, MISS.—The Columbus Railway, Light & Power Company is installing a new 1000-hp. steam turbine, which will double the output of its plant.

BATESVILLE, ARK.—Improvements are contemplated to the municipal electric-light plant and waterworks system.

FORT SMITH, ARK.—The Coal District Power Company, recently incorporated with a capital stock of $120,000 to furnish electrical service to towns and mines in Sebastian County, has taken options on electric plants in Greenwood, Hartford, Mansfield and Booneville. Hugh Means of Lawrence, Kan., is president of the company.

LOCKESBURG, ARK.—The Arkansas Light & Power Company of Arkadelphia has been granted a franchise to supply electricity in Lockesburg.

PARIS, ARK.—Preliminary surveys are being made in connection with the installation of the proposed municipal electric-light plant and water-works system. Winters & Dove of Fort Smith are engineers.

COLFAX, LA.—Negotiations are under way between the Town Council and the Colfax Light & Power Company for the purchase of the local electric plant. If the electric plant is taken over by the town the output will be doubled. The installation of a water-works system is also under consideration.

MONROE, LA.—At an election to be held March 20 the proposal to issue $612,000 in bonds, of which the proceeds of $61,000 will be used for construction of power house and reconstruction of electric generating plant, and $146,000 for filtering plant and reconstruction of water-works system, the remainder for street improvements, etc.

BARTLESVILLE, OKLA.—The City Council has granted the Oklahoma & Northern Traction Company a franchise to build an electric railway from Bartlesville to Miami. W. K. Palmer & Company, 919 Baltimore Avenue, Kansas City, Mo., are engineers.

CLINTON, OKLA.—The city of Clinton is contemplating the installation of an ornamental lighting system on ten blocks and rebuilding power transmission lines on account of paving. N. E. Stone is superintendent.

FREDERICK, OKLA.—At an election to be held March 20 the proposal to issue $75,000 in bonds for extension of the waterworks system and for purchase and improvements to the electric-lighting plant of the Foster-Harris Gin & Electric Company will be submitted to the voters.

MILL CREEK, OKLA.—The City Council is considering the installation of a municipal electric-lighting system.

POND CREEK, OKLA.—The city of Pond Creek is considering securing energy from a transmission system some time this summer to operate the municipal electric-light system. At present the plant is driven by steam power. C. C. Shepard is superintendent.

SALLISAW, OKLA.—The Board of Trustees is planning to install a 500-kw. generating unit and boilers in the municipal electric-light plant this spring. George E. McCants is general manager.

TULSA, OKLA.—The Tulsa Traction Company contemplates extensions to its system in several directions. The railway to Bixby will be extended to Muskogee, to Okmulgee, thence to Nowata via Collinsville and Oolagah. A line will also be built from Tulsa to Sapulpa. Plans are also being considered for the construction of a railway system connecting the various oil field towns, forming a belt line having terminus in Tulsa.

AMARILLO, TEX.—The City Light & Water Company, it is reported, contemplates improvements to its water works system, involving an expenditure of about $106,000.

BROWNWOOD, TEX.—As the result of the special rate given by the Texas Power & Light Company local merchants will install approximately 500 lamps.

DALLAS, TEX.—Improvements are contemplated to the street lighting system, involving an expenditure of about $6,000.

Pacific States

BREMERTON, WASH.—The City Council is considering the purchase of the local electric light plant, owned by the North Pacific Public Service Corporation, to be owned and operated by the municipality. The plant also supplies electrical service in the towns of Charleston and Port Orchard.

INDEX, WASH.—The Council has engaged G. N. Miller & Son, engineers, Burke Building, Seattle, to complete surveys for the proposed municipal power plant and water works system for which $20,000 in bonds were recently voted. Power will be secured from Deer Creek.

TACOMA, WASH.—Work will soon begin on the construction of a new power plant on the tidelands for the Wheeler-Osgood Company, to cost between $30,000 and $40,000. A permit has been granted for the erection of a smokestack 150 ft. A battery of boilers to furnish power for the generators will be installed. About 1800 hp. will be developed.

TACOMA, WASH.—The Tacoma Railway & Power Company has applied to the Commissioners of Thurston County for a franchise to erect electric transmission lines along certain roads in Thurston County. The company proposes to extend its transmission lines from the Tacoma city limits through Thurston County to serve small villages and farming districts. The initial line will be from the Tacoma city limits to the Brown Ranch at Nisqually.

WAPATO, WASH.—The Pacific Power & Light Company has petitioned the Council for a new franchise, which if granted will provide for the reconstruction of the local street lighting system.

MEDFORD, ORE.—The formation of a co-operative district to be bonded for the construction of an electric power plant and irrigation system has been proposed by W. J. Scott of Antioch. The proposed district will include 25,000 acres of land in Sams Valley. The cost of the project is estimated at about $1,000,000.

SALEM, ORE.—A valuable power site near Salem, recently purchased by the C. K. Spaulding Logging Company, it is reported, will be used to develop power for a large paper mill.

BANNING, CAL.—Application has been made to the State Water Commission by Marcus Pluth, 111 West Ninetieth Street, Los Angeles, for permission to appropriate 60 miner's inches of water from Snow Creek and Whitewater River for power purposes; also to construct four hydro-electric plants, two on each stream.

ESCONDIDO, CAL.—The San Diego Consolidated Gas & Electric Company, which recently purchased the property of the Escondido Utilities Company, contemplates the erection of a 22,000-volt transmission line from Olivenhain to Escondido, 10 miles long, to cost $21,290, and a 11,000-volt line from Vista to Escondido, a distance of 13 miles, to cost about $14,141.

LOS ANGELES, CAL.—The Atchison, Topeka & Santa Fé Railroad Company is considering the extension of the electric automatic block signal system over its entire lines within the state during 1917, at a cost of about $500,000.

LOS ANGELES, CAL.—The city of Los Angeles has applied to the State Water Commission for permission to divert 200 second ft. per second of water from the south fork of Kern River in Tulare County for the purpose of generating electricity. The city contemplates the construction of a diversion dam, 20 ft. high, 150 ft. long at top, conduit pipe line 5½ miles long to carry water to the proposed power house, to cost about $1,500,000. This to be the first unit of a number of hydroelectric plants, the others to be located in Inyo and Mono Counties. William Mullholland is chief engineer of board of public service.

SAN BERNARDINO, CAL.—The installation of a municipal electric-light plant in San Bernardino is under consideration.

VISALIA, CAL.—The Board of Supervisors has awarded the Mount Whitney Power & Electric Company a 50-year franchise to erect and operate electric transmission lines on the roads and highways of Kings County.

LEWISTON, IDAHO.—The creation of an auxiliary organization for the purpose of promoting the construction of a power and storage dam at or near Lewiston for municipal purposes has been authorized by the governing board of the Commercial Club.

POCATELLO, IDAHO.—The Pocatello Traction & Interurban Company, it is reported, contemplates extensions to its system, involving an expenditure of $1,500,000.

POCATELLO, IDAHO.—The committee appointed to investigate the proposal of Joseph Burns to establish a municipal electric-light and power plant, recommends that an electrical engineer be employed to make investigations and estimates of cost of such a plant.

SHELLEY, IDAHO.—The Shelley Light & Power Company contemplates the reconstruction of its local distribution lines this spring and is also considering extending its transmission lines to three or four neighboring towns within a radius of 6 miles. A. C. Schweitzer is superintendent.

SALT LAKE CITY, UTAH.—The Utah Power & Light Company has applied to the City Commission for a franchise to operate a heating plant to supply heat for the greater part of the city. The proposed plan will involve laying underground conduits for steam pipes to connect the various plants.

SNOWFLAKE, ARIZ.—The installation of a municipal electric-light plant in Snowflake is under consideration.

KALISPELL, MONT.—The County Commissioners have granted the Northern Idaho & Montana Power Company of Sandpoint permission to erect an electric transmission line and telephone line to run from Bigfork to Polson along the east shore of Flathead Lake, and from Polson to Ravalli, via Ronan and Mission. The line will also connect Dayton and Polson on the west shore of Flathead Lake.

HAXTON, COL.—The City Council has decided to install a municipal electric light plant for which $15,000 has been appropriated.

COLUMBUS, N. M.—The Columbus Electric Light & Power Company, recently organized with a capital stock of $200,000, proposes to construct a large electric power plant near here to supply electricity for lamps and motors in Columbus, and will also erect transmission lines into adjacent territory and furnish energy to operate pumping plants and other industries. J. L. Greenwood is interested in the project.

Canada

WINNIPEG, MAN.—Surveys have been made by the British North American Hydro Electric Power Company of Winnipeg in connection with a proposed power development in Manitoba, which will involve an expenditure of several million dollars.

ATHENS, ONT.—The local electric light plant and telephone exchange were recently destroyed by fire.

SUDBURY, ONT.—Improvements involving an expenditure of about $7,000 are contemplated to the municipal electric light plant.

Miscellaneous

PANAMA.—BIDS will be received at the office of the purchasing officer, the Panama Canal, Washington, D. C., until March 14 for furnishing galvanized steel, steel plates, driving-wheel centers, ferro-titanium wire, grommets, street-lighting units, valves, watt-hour meters, etc. Blanks and information relating to this circular (No. 1126) may be obtained from the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and Fort Mason, San Francisco, Cal.

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until March 12 for furnishing planer cylinders, brass sockets, oil cups, engine lubricators, safety valves, steam whistles, steam gages, gage lamps, sockets, ignition cable, etc. Blanks and information relating to this circular (No. 1128) may be obtained at the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y., and Whitney-Central Building, New Orleans, La.

Directory of Electrical Associations

Printed in the First Issue of Each Month

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary-treasurer, J. P. Ross, Birmingham Railway, Light & Power Co.

AMERICAN ASSOCIATION OF ENGINEERS. Secretary, Arthur Kneisel, 29 South LaSalle St., Chicago, Ill.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE. Permanent Secretary, L. O. Howard, Smithsonian Institution, Washington, D. C.

AMERICAN ELECTRIC RAILWAY ASSOCIATION. Secretary, E. B. Burritt, 8 West 40th St., New York.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS. Secretary, F. A. Molitor, 35 Nassau St., New York City.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, F. L. Hutchinson, 33 West 39th St., New York, Board of directors meets monthly. Sections and branches in the principal electrical centers throughout the country. Annual convention, Hot Springs, Va., June 26-29.

AMERICAN PHYSICAL SOCIETY. Secretary, Prof. A. D. Cole, Ohio State University, Columbus, Ohio.

AMERICAN SOCIETY OF TESTING MATERIALS. Secretary-treasurer, Edgar Marburg, University of Pennsylvania, Philadelphia.

ARKANSAS ASSOCIATION OF PUBLIC UTILITY OPERATORS. Secretary-treasurer, Roy B. Fowles, Pine Bluff, Ark. Annual convention Pine Bluff, May 16-18.

ASSOCIATED MANUFACTURERS OF ELECTRICAL SUPPLIES. General Secretary, C. E. Dustin, 62 Cedar St., New York. Annual meeting, Delmonicos, New York City, March 15.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, George C. Holberton, San Francisco, Cal.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, John F. Kelly, McKeesport, Pa.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary-treasurer, Jos. A. Andreucetti, Chicago & Northwestern Railway, Chicago.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS. Secretary, P. W. Drew, 112 West Adams St., Chicago.

BRITISH COLUMBIA ASSOCIATION OF ELECTRICAL CONTRACTORS AND DEALERS. Secretary-treasurer, E. Brettell, Electric Supply Company, Ltd., Vancouver, B. C.

CALIFORNIA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, James Redpath, 505 Rialto Bldg., San Francisco, Cal.

CANADIAN ELECTRICAL ASSOCIATION. Affiliated with N. E. L. A. Secretary-treasurer, Alan Sullivan, Excelsior Life Building, Toronto, Can.

COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION. Secretary-treasurer, T. F. Kennedy, 900 15th St., Denver, Col.

COMMERCIAL SECTION, N. E. L. A. Secretary, F. D. Beardslee, Union Electric Light & Power Company, St. Louis, Mo.

EASTERN NEW YORK SECTION N. E. L. A. Secretary, J. E. Kearns, General Electric Company, Schenectady, N. Y.

ELECTRICAL CONTRACTORS' ASSOCIATION OF CONNECTICUT. Secretary, George M. Chapman, Waterbury, Conn.

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ELECTRICAL CONTRACTORS' ASSOCIATION OF STATE OF MISSOURI. Secretary, A. J. Burns, 318 West Tenth St., Kansas City, Mo.

ELECTRICAL CONTRACTORS' ASSOCIATION OF THE STATE OF PENNSYLVANIA. Secretary, M. G. Sellers, 1518 Sansom St., Philadelphia.

ELECTRICAL CONTRACTORS' ASSOCIATION OF WISCONSIN. Secretary, J. C. Staff, 578 Jackson St., Milwaukee, Wis.

ELECTRICAL DEALERS' AND CONTRACTORS' ASSOCIATION OF ONTARIO. Secretary, E. A. Drury, 45 Murray St., Toronto, Can.

ELECTRICAL MANUFACTURERS' CLUB. Secretary, H. B. Crouse, Crouse-Hinds Co., Syracuse, N. Y.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION. General Secretary, Franklin Overbagh, 411 South Clinton St., Chicago, Ill. Semi-annual meeting Hot Springs, Va., May 22-24.

ELECTRICAL TRADES ASSOCIATION OF CANADA. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Can.

ELECTRICAL TRADES ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert H. Elliott, 34 Ellis St., San Francisco, Cal.

ELECTRIC POWER CLUB. Secretary, C. H. Roth, 1410 West Adams St., Chicago.

ELECTRIC VEHICLE ASSOCIATION OF AMERICA. Affiliated with the N. E. L. A. Secretary, A. Jackson Marshall, 29 West 39th St., New York.

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, 29 West 39th St., New York.

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GAS, ELECTRIC AND STREET RAILWAY ASSOCIATION OF OKLAHOMA. Secretary-treasurer, Prof. H. V. Bozell, Norman, Okla.

GEORGIA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, Gadsden Russell, Atlanta, Ga.

ILLINOIS STATE ELECTRIC ASSOCIATION. Secretary, R. H. Abbott, Petersburg, Ill.

ILLINOIS ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, M. L. Blumenthal, 179 West Washington St., Chicago, Ill.

ILLUMINATING ENGINEERING SOCIETY. General secretary, G. H. Stickney, 4th and Sussex Sts., Harrison, N. J. Sections in New York, Philadelphia, Pittsburgh, Cleveland, Chicago and Boston. Annual convention September.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary, Thomas Donahue, Lafayette, Ind.

INDIANA STATE ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, George Skillman, Indianapolis, Ind.

INDUSTRIAL ELECTRIC HEATING ASSOCIATION. Secretary, Homer Kunz, Toledo Railways & Light Co., Toledo, Ohio.

INSTITUTE OF OPERATING ENGINEERS. Secretary, L. Houmiller, 29 West 39th St., New York.

INSTITUTE OF RADIO ENGINEERS. Secretary, David Sarnoff, 111 Broadway, New York.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, C. R. George, Houston, Tex.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). General Secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England.

IOWA SECTION N. E. L. A. Secretary-treasurer, L. E. Caldwell, Iowa City, Iowa. Annual meeting, Des Moines, May 25 and 26.

IOWA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, M. T. Humphrey, Waterloo, Iowa.

JOVIAN ORDER. Jupiter (president), Henry L. Doherty, New York City; Mercury (secretary), E. C. Bennett, Syndicate Trust Building, St. Louis, Mo.

KANSAS ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, J. A. Mercer, 108 West Eighth Ave., Topeka, Kan.

KANSAS PUBLIC SERVICE ASSOCIATION. Secretary, E. A. Wright, Manhattan, Kan.

KENTUCKY ASSOCIATION OF ELECTRICAL CONTRACTORS. Secretary, Herbert E. Ottenheimer, Louisville, Ky.

LOUISIANA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, J. J. Zeigler, 227 Bourbon St., New Orleans.

MAINE ELECTRIC ASSOCIATION. Secretary-treasurer, Walter S. Wyman, Waterville, Maine.

MICHIGAN SECTION, N. E. L. A. Secretary. Herbert Silvester, 18 Washington Boulevard, Detroit, Mich.

MINNESOTA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, G. M. Jones, 14 Seventh St., N., Minneapolis, Minn.

MINNESOTA ELECTRICAL ASSOCIATION. Secretary, Fred A. Otto, St. Paul, Minn.

MISSISSIPPI ELECTRIC ASSOCIATION. Affiliated with the N. E. L. A. Secretary-treasurer, R. H. Smith, Jackson, Miss.

MISSOURI ASSOCIATION OF PUBLIC UTILITIES. Secretary-treasurer, F. D. Beardslee, Union Electric Light & Power Co., St. Louis.

NATIONAL ARM, PIN AND BRACKET ASSOCIATION. Secretary, J. B. Magers, Madison, Ind.

NATIONAL ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary-treasurer, William L. Smith, Concord, Mass. Biennial Convention, New York, March 27-29.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive secretary, T. C. Martin, 33 West 39th St., New York. Annual meeting Atlantic City, N. J., May 29 to June 1.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, George H. Duffield, 41 Martin Building, Utica, N. Y. Next meeting, New Orleans, October, 1917.

NATIONAL ELECTRICAL CREDIT ASSOCIATION. Secretary, Frederic P. Vose, 1343 Marquette Bldg., Chicago, Ill.

NATIONAL FIRE PROTECTION ASSOCIATION. Secretary of electrical committee, Ralph Sweetland, 141 Milk St., Boston, Mass. Biennial meeting, New York City, March 28, 29.

NEBRASKA SECTION, N. E. L. A. Secretary-treasurer, B. E. Egan, Room 201, Union Pacific Building, Omaha, Neb.

NEW ENGLAND ELECTRICAL CREDIT ASSOCIATION. Secretary, Alton F. Tupper, 60 State St., Boston, Mass.

NEW ENGLAND SECTION, N. E. L. A. Secretary, Miss O. A. Bursiel, 149 Tremont St., Boston, Mass.

NEW MEXICO ELECTRICAL ASSOCIATION. Secretary-treasurer, E. A. Thiele, Roswell, N. M.

NEW YORK ELECTRICAL CREDIT ASSOCIATION, Secretary, Franz Neilson, 120 Broadway, New York.

NEW YORK ELECTRICAL SOCIETY. Secretary, George H. Guy, 29 West 39th St., New York.

NORTHWEST SECTION, N. E. L. A. Secretary, J. F. Farquhar, Washington Water Power Company, Spokane, Wash.

NORTHERN WHITE CEDAR ASSOCIATION. Secretary, R. N. Boucher, 743 Lumber Exchange, Minneapolis, Minn.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus.

OREGON ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary-treasurer, J. W. Oberender, 502 Dekum Building, Portland, Ore.

PENNSYLVANIA ELECTRIC ASSOCIATION. (State Section N. E. L. A.) Secretary, H. M. Stine, 211 Locust St., Harrisburg, Pa.

PUBLIC SERVICE ASSOCIATION OF VIRGINIA. Secretary, W. J. Kehl, Virginia Railway & Power Co., Richmond, Va.

PUBLIC UTILITIES ASSOCIATION OF WEST VIRGINIA. Secretary, W. C. Davisson, West Virginia Water & Electric Co., Charleston, W. Va.

RADIO CLUB OF AMERICA. Secretary, David S. Brown, 206 West 86th St., New York.

RAILWAY SIGNAL ASSOCIATION. Secretary-treasurer, C. E. Rosenberg, Times Building, Bethlehem, Pa.

ROCKY MOUNTAIN ASSOCIATION OF MUNICIPAL ELECTRICIANS. President, Lawrence Stone, Denver, Col.

SOCIETY FOR ELECTRICAL DEVELOPMENT, INC. General manager, J. M. Wakeman, 29 West 39th St., New York.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Dean F. L. Bishop, University of Pittsburgh, Pittsburgh, Pa.

SOUTH DAKOTA ELECTRIC LIGHT ASSOCIATION. Secretary, A. H. Savage, Dakota Light & Power Co., Flandreau, S. D.

SOUTHEASTERN SECTION, N. E. L. A. Secretary-treasurer, George H. Wygant, Tampa, Fla.

SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION. Secretary, H. S. Cooper, 405 Slaughter Building, Dallas, Tex. Annual convention, Dallas, April 26-28.

TEXAS STATE ASSOCIATION OF ELECTRICAL CONTRACTORS. Secretary, Eugene Ashe, Dallas, Tex.

TRI-STATE WATER & LIGHT ASSOCIATION. Secretary-treasurer, W. F. Steiglitz, Columbia, S. C. Meeting, Macon, Ga., April 17-19.

VERMONT ELECTRICAL ASSOCIATION. Secretary-treasurer, C. H. West, Rutland, Vt.

VIRGINIA STATE ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, E. M. Andrews, Richmond.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 175 Jackson Bldg., Chicago, Ill.

WESTERN SOCIETY OF ENGINEERS, ELECTRICAL SECTION. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago.

WISCONSIN ELECTRICAL ASSOCIATION. Secretary, George Allison, 1410 First National Bank Building, Milwaukee, Wis. Annual meeting Milwaukee, Wis., March 15-16.

1,216,294. COMBINED CAR, TRAIN-PIPE, AND ELECTRIC COUPLING; James S. Doyle, Mount Vernon, and Frank Hedley, Yonkers, N. Y. App. filed March 24, 1913. Improvement.

1,216,301. HEATING DEVICE FOR WATER-JACKETED CARBURETERS; Rev. A. Fisk, Amboy, Minn. App. filed June 1, 1916. Water in the water jacket will be kept in proper circulation during the operation of the engine.

1,216,305. AUTOMATIC TELEPHONE SYSTEM; Charles L. Goodrum, New York, N. Y. App. filed May 10, 1915. Improvements.

1,216,313. ELECTRIC HEATER; Leo Heller, Teplitz, Austria-Hungary. App. filed Dec. 10, 1915. For cooking utensils.

1,216,319. REEL FOR ELECTRIC CONDUCTORS; Harry R. Huling, Schuylkill Haven, Pa. App. filed Sept. 15, 1913. Used in connection with an automobile.

1,216,323. TELEPHONE-SUBSCRIBER'S CALLING MECHANISM; Alexander E. Keith, Hinsdale, Ill. App. filed Aug. 7, 1907. Improvement.

1,216,331. CHANGEABLE VAULT STRUCTURE FOR ELECTRIC MELTING-FURNACES; Bernhard Christian Kvaerno, Haugesund, Norway. App. filed Nov. 10, 1916. Whereby certain inconveniences existing in the constructions hitherto known are avoided.

1,216,337. ELECTRIC CONDUCTOR; Alfred H. McCulloch and Caroline D. McCulloch, Boston, Mass. App. filed Dec. 2, 1912. Improvement in the coverings.

1,216,365. AUTOMATIC TELEPHONE SYSTEM; Clarence E. Rogers, Oakland, Cal. App. filed Dec. 12, 1913. Improved means for uniting into one system two-wire and three-wire apparatus.

1,216,369. RAILWAY SIGNALING; John E. Saunders, Edgewood Borough, Pa. App. filed Sept. 12, 1914. Improvements.

1,216,370. TELLTALE AND SWITCH FOR REAR SIGNAL-LIGHTS FOR AUTOMOBILES; Wendelin P. Seng, Chicago, Ill. App. filed Dec. 24, 1915. New and useful.

1,216,371. PROCESS FOR THE MANUFACTURE OF HYDROXID OF ALUMINUM; Botho Schwerin, Frankfort-on-the-Main, Germany. App. filed May 13, 1915. Makes use of the sodium aluminate liquor produced in the usual way from bauxite.

1,216,372. TROLLEY-HANGER; James Scott, Cleveland, Ohio. App. filed May 20, 1916. Improvements.

1,216,379. VIBRATOR FOR INDUCTION-COILS; Henry C. Thomson, Boston, and Harold N. Michaelsen, Canton, Mass. App. filed Feb. 10, 1914. Improvements.

1,216,380. EXHIBITION-SCREEN FOR PROJECTING-MACHINES; John F. Robert Troeger, Brooklyn, N. Y. App. filed Dec. 24, 1913. Translucent screen.

1,216,386. ELECTRIC SWITCH; Anthony F. Williams and Edward A. Halbleib, Rochester, N. Y. App. filed Jan. 9, 1917. Improvements.

1,216,397. INDUCTION-MOTOR; Benjamin F. Bailey, Ann Arbor, Mich., and John Martin Barr, Orlo S. More, and L. Guy Long, Indianapolis, Ind. App. filed Feb. 15, 1913. Internal controlling mechanism dependent in its action solely upon the speed of the motor.

1,216,404. SELF-IGNITING ELECTRIC-ARC CANDLE; Jean Billiter, Vienna, Austria-Hungary. App. filed Jan. 28, 1914. Two parallel electrodes and an intermediate layer between said electrodes.

1,216,406. ELECTRICAL RECEPTACLE FOR CONDUIT OUTLET-BOXES; Carl H. Bissell, Syracuse, N. Y. App. filed Dec. 27, 1910. New and useful.

1,216,413. CURRENT-CONVERTING DEVICE; Arthur R. Bullock, Cleveland, Ohio. App. filed July 28, 1913. Employ a rotatable body of segments.

1,216,420. RELAY; Frank L. Dodgson, Rochester, N. Y. App. filed Dec. 1, 1914. Electric signaling systems for railways.

1,216,422. PORTABLE ELECTRIC LAMP; William P. Dunham, Los Angeles, Cal. App. filed April 21, 1914. Movable base.

1,216,429. REFILLABLE INDICATING-FUSE; George W. Fiske, Akron, Ohio. App. filed Feb. 2, 1915. Cartridge fuses.

1,216,435. TRAFFIC-INDICATOR FOR AUTOMOBILES; John M. Gillies and Andrew Moynihan, Salem, N. Y. App. filed Jan. 5, 1916. Operated to indicate the direction of travel intended by the operator, and which may be illuminated for night service.

1,216,446. ELECTROMAGNETIC APPARATUS; Clinton O. Harrington, Edgewood Borough, Pa. App. filed March 9, 1915. Causing repeated operation of a member.

1,216,450. ELECTRIC BATTERY; Major E. Holmes, Lakewood, Ohio. App. filed Nov. 21, 1912. Improvement.

1,216,451. BATTERY-DEPOLARIZER; Major E. Holmes, Lakewood, Ohio. App. filed Nov. 22, 1913. Improvement.

Record of Electrical Patents

Notes on United States Patents issued on Feb. 20, 1917

1,216,461. TELEPHONE RING-BACK OR REVERTING-CALL SYSTEM; Geo. E. Kimball, Rochester, Pa. App. filed June 23, 1909. Provide an improved ring-back or reverting call arrangement whereby one subscriber may call another on the same line.

1,216,466. ASSEMBLING-MACHINE; Joseph Ledwinka, Philadelphia, Pa. App. filed April 14, 1915. Applicable to machines for assembling automobile bodies.

1,216,467. ASSEMBLING-MACHINE; Joseph Ledwinka, Philadelphia, Pa. App. filed May 6, 1915. Applicable to machines for assembling metal vehicle fenders, such as automobile fenders.

1,216,480. TELEPHONE; Katherine Nichols, Cincinnati, Ohio. App. filed April 19, 1915. Particularly directed to a type of instrument having two receivers.

1,216,481. SIGNALING DEVICE FOR AUTOMOBILES; Harvey P. Noble, Philadelphia, Pa. App. filed April 30, 1915. Improvements.

1,216,513. KNIFE-BLADE SWITCH; Alexander K. Sutherland, Plainville, Conn. App. filed Nov. 26, 1915. Locking means.

1,216,406. Electrical Receptacle for Conduit Outlet Boxes

1,216,518. ELECTRICAL REGULATOR; Allen A. Tirrill, Pittsburgh, Pa. App. filed Jan. 5, 1915. Regulation is effected by opening and closing a shunt circuit to a resistance in series with the field magnet winding of an exciter or other dynamo-electric machine.

1,216,533. ELECTRICAL TELEGRAPH AND INDICATOR SYSTEM; Frank W. Wood, Brooklyn, N. Y. App. filed June 24, 1915. Used on shipboard for transmitting orders between different points on the ship.

1,216,534. AUTOMATIC TELEPHONE SYSTEM; George A. Yanochowski, Chicago, Ill., and Harry E. Hershey, Whitewater, Kan. App. filed Nov. 28, 1913. Improvements.

1,216,538. MEANS FOR PRODUCING ELECTRICAL OSCILLATIONS; Georg Graf Arco and Ragnar Hakan Rendahl, Berlin, Germany. App. filed Jan. 8, 1917. Particularly for use in radio-telegraph.

1,216,545. WIRE-CONNECTOR; Joseph E. Burgess, St. Louis, Mo. App. filed April 21, 1916. Connected to the adjacent portions of a broken wire of an electric circuit to serve as a temporary connection.

1,216,553. PUSH-BUTTON; Halley C. Dolan, Detroit, Mich. App. filed April 26, 1915. Multiple switch by which a plurality of electrical circuits can be easily controlled.

1,216,559. SWITCH-LOCK FOR MOTOR-VEHICLES; Gustav Frank, Jefferson, Tex. App. filed Oct. 1, 1913. Suitable indicating means with the lock.

1,216,570. ELECTROMAGNETIC TIME-RETARDING RELAY; Karl Hohn, Zurich, Switzerland. App. filed June 16, 1915. Particularly adapted to be mounted in switch boxes.

1,216,595. TRANSMISSION OF ELECTRICAL IMPULSES OVER CIRCUITS OF HIGH ELECTROSTATIC CAPACITY; Giuseppe Musso, Vado, Italy. App. filed March 14, 1914. Method of improving, both in quality and efficiency.

1,216,598. HOLDING MEANS FOR HOUSINGS; Herman G. Pape, New York, N. Y. App. filed June 23, 1916. New and useful.

1,216,605. ELECTRIC HEATER; Joseph Porzel, Buffalo, N. Y. App. filed May 14, 1915. Improvements.

1,216,615. APPARATUS FOR PRODUCING POWERFUL ELECTRICAL OSCILLATIONS; George Seibt, New York, N. Y. App. filed Dec. 27, 1909. Particularly showing damped oscillations capable of being radiated, received and detected in the form of a high musical note.

1,216,633. X-RAY TABLE; Julius B. Wantz, Chicago, Ill. App. filed Jan. 15, 1915. Adapted for either fluoroscopic or radiographic work.

1,216,641. AUTOMATIC TELEPHONE SYSTEM; Charles S. Winston, Chicago, Ill. App. filed Feb. 19, 1913. Particularly with metallic line or two-wire control circuits for controlling the operation of selective switches.

1,216,643. COMPOSITION FOR POLISHING IRON; Mataichi Yasuda, Koishigawa, Tokyo, Japan. App. filed March 14, 1914. Composition of matter for removing rust and the like from iron.

1,216,646. METHOD OF PRODUCING HIGH-FREQUENCY OSCILLTING CURRENTS; James C. Armor, Ingram, Pa. App. filed Oct. 14, 1911. From either direct or alternating-current sources.

1,216,647. MEANS FOR PRODUCING HIGH-FREQUENCY OSCILLATORY CURRENTS; James C. Armor, Brooklyn, N. Y. App. filed Nov. 23, 1911. Particularly adapted for the direct production of intermittent unidirectional impulses.

1,216,651. ELECTRICAL MAKE-AND-BREAK TRIPPING MECHANISM FOR TWO OR FOUR CYCLE GAS ENGINES; Matthew H. Borland, Seekonk, Mass. App. filed March 15, 1916. Improvement.

1,216,678. BILGE-WATER ALARM; Charles R. Ford, Paducah, Ky. App. filed Sept. 22, 1915. Indicating the depth of water.

1,216,720. WIRELESS-TELEGRAPH TRANSMITTER OF THE PORTABLE TYPE; Marion Alvin Mulrony, Randwick, near Sydney, New South Wales, Australia. Improvements. App. filed July 23, 1915.

1,216,743. ELECTRIC BELL; William J. Smith, New York, N. Y. App. filed March 13, 1913. Alternating-current circuit.

1,216,756. DIMMER FOR ELECTRIC LAMPS; Ira C. Williams and Charles F. Williams, Albany, Ind. App. filed June 12, 1916. May also be used as a rheostat for any other purpose.

1,216,776. TELEPHONE ATTACHMENT; John J. Convery, New York, N. Y. App. filed July 25, 1916. Receiver-holding and hook-operating attachment for telephones.

1,216,792. IGNITION SYSTEM; Valere Alfred Fynn, St. Louis, Mo. App. filed April 13, 1914. In connection with internal combustion engines.

1,216,819. LIGHTING FIXTURE; Ferdinand C. Krueger, Milwaukee, Wis. App. filed June 14, 1916. Lighting may be both direct or indirect.

1,216,820. ELECTRIC SIGNAL; Theodore P. Lancaster, Boston, and James L. Struthers, Lynn, Mass. App. filed April 29, 1914. Automobile signal.

1,216,828. AUTOMOBILE HORN; Ray H. Manson, Elyria, Ohio. App. filed Sept. 29, 1913. Increase the sound produced by horns of the vibrator type.

1,216,829. ELECTRIC MUSICAL INSTRUMENT; Harry S. Martin, Boston, Mass. App. filed April 29, 1916. Sonorous body is vibrated through the influence of appropriately timed magnetic pulsations.

1,216,844. ELECTRICAL CONTROLLING SYSTEM; John G. Roberts, Dobbs Ferry, N. Y. App. filed Dec. 8, 1914. Multi-office telephone exchange systems.

1,216,862. ELECTRIC PENCIL; Amada E. Sickles, Coyle, Okla. App. filed May 14, 1915. Electric light has its bulb arranged near the writing point.

1,216,867. CONTROL OF CURRENT TO LARGE INDUCTANCES; John C. Smith, Louisville, Ky. App. filed Oct. 14, 1912. Prevention of sparking at switch contacts.

1,216,883. DETACHABLE ATTACHMENT-PLUG; George B. Thomas, Bridgeport, Conn. App. filed July 17, 1914. Simple in construction and efficient in operation.

1,216,884. LAMP-GRIP; George B. Thomas, Bridgeport, Conn. App. filed August 25, 1914. To prevent backing out.

1,216,887. INDUCTIVE WIRELESS-TELEPHONE SYSTEM FOR RAILROADS AND THE LIKE; Thor Gustaf Thornblad, Karl Hjalmar Warfvinge, and Victor Gabriel Werner, Stockholm, Sweden. App. filed June 6, 1914. Improvements.

1,216,888. ELECTRICAL REGULATOR; Allen A. Tirrill, Pittsburgh, Pa. App. filed March 3, 1914. Improvement.